

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
26 February 2004 (26.02.2004)

PCT

(10) International Publication Number
WO 2004/016853 A1

(51) International Patent Classification⁷: **E01B 23/06**,
3/20, 3/24, 7/22

(21) International Application Number:
PCT/GB2003/003555

(22) International Filing Date: 14 August 2003 (14.08.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0219066.8 16 August 2002 (16.08.2002) GB
0311403.0 17 May 2003 (17.05.2003) GB

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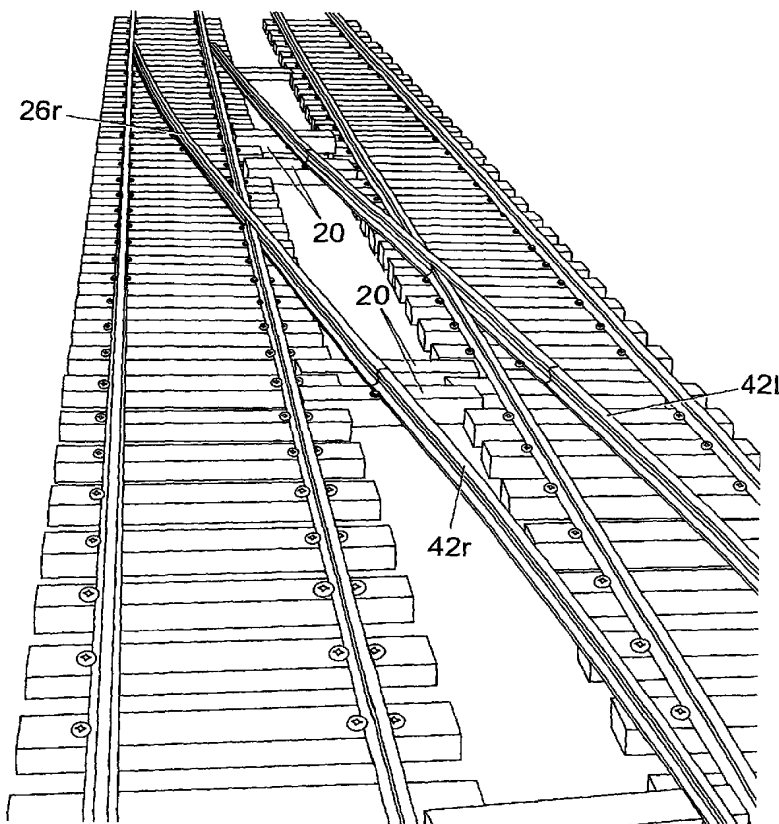
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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE,
SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,
VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[Continued on next page]

(54) Title: TURNOUT/CROSSOVER SECTION FOR RAILWAY TRACK



(57) Abstract: A turnout for a railway track having a raised track surface to provide a path along which the wheels of a train can travel from one railway track to another. The raised track surface is of a sufficient height such that the wheels of the train are arranged to clear each railway track being crossed. The turnout facilitates Single Line Working on a second railway track to clear a first railway track for maintenance or other purposes. Pot sleepers for supporting rails of a railway track (10) and a method of installing them is also described.

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ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

1 "Turnout/Crossover Section for Railway Track"

2

3 The present invention relates to a turnout or
4 crossover section of railway track and particularly
5 but not exclusively relates to providing a temporary
6 non-intrusive turnout or crossover section of a
7 railway track.

8

9 Railway track requires to be maintained at regular
10 intervals and in order to do this, the section of
11 track that is being maintained must be cleared of
12 trains. The track is normally closed to traffic
13 often during no train periods and also out-with such
14 periods thus causing train cancellations or trains
15 being diverted to other routes for short or longer
16 terms (blockades). In some instances, the trains
17 are transferred from the track having the
18 maintenance performed on it onto an adjacent track
19 for a limited period (i.e. a few hours) and then
20 back onto the original track. The trains are
21 transferred onto the adjacent track by means of a
22 crossover section of track and returned by means of

1 a second crossover. This is known in the art as
2 "Single Line Working" (SLW). Conventionally, each
3 of the crossover sections are intrusive, in that the
4 section of track at which the crossover section is
5 inserted must be cut; this involves cutting the
6 existing rails of each railway track twice and
7 installing the temporary crossover and also
8 installing the switchgear along with providing an
9 interface for signalling. However, such an
10 intrusive crossover section is relatively expensive
11 and requires a fairly long time to plan and to
12 install, where the planning stage alone may take in
13 the region of 2 years. The only other known
14 alternative to solve this problem is to allow the
15 trains to crossover at the nearest permanent
16 crossover sections before and after the maintenance
17 site but these may be many miles away and thus if
18 repair or maintenance is required on only a few
19 metres of track, trains may be forced to share one
20 line of track for both directions (i.e. SLW) for
21 many miles or may be extensively diverted onto
22 alternative routes, thus leading to inefficiency and
23 delays.

24

25 Those in the rail industry will also realise that
26 there is a conflict between passengers who require
27 train services during the daytime and freight trains
28 which operate during the night and thus there is
29 very little time to effect such repairs and
30 maintenance. The overriding difficulty is access to
31 the track for cost efficient maintenance.

32

1 It will be understood by those skilled in the art
2 that a crossover comprises two individual turnouts,
3 where a turnout can be used on its own or can be
4 combined with another turnout to form a crossover.

5

6 In the context of this application, it should be
7 noted that a non-intrusive crossover is one that
8 does not pass through the rail to be crossed but
9 instead crosses over the rail to be crossed.

10

11 According to a first aspect of the present invention
12 there is provided a turnout for a railway track, the
13 turnout comprising a raised track surface which is
14 adapted to provide a path along which the wheels of
15 a train can travel from one railway track to
16 another, wherein the raised track surface is of a
17 sufficient height such that the wheels of the train
18 are arranged to clear the said railway tracks.

19

20 According to a first aspect of the present invention
21 there is also provided a method of transferring a
22 train from one railway track to a second railway
23 track, the method comprising the steps of:-

24 providing a raised track surface which is
25 adapted to provide a path along which the wheels of
26 the train can travel from the first to the second
27 railway track;

28 driving the train along the first track and
29 onto the raised track surface, wherein the raised
30 track surface is of a sufficient height such that
31 the wheels of the train are arranged to clear at

1 least one (and preferably both) of the first and
2 second railway tracks.

3
4 The invention has the advantage that it permits
5 short length Single Line Working.

6
7 Preferably, a crossover comprises a pair of said
8 turnouts.

9
10 According to a second aspect of the present
11 invention, there is provided a system for
12 facilitating Single Line Working on a second railway
13 track to clear a first railway track for maintenance
14 or other purposes, the system comprising a first and
15 a second non-intrusive crossover being spaced apart
16 from the first non-intrusive crossover in the
17 direction of the longitudinal axis of the pair of
18 railway tracks, in order to provide a path along
19 which wheels of a train can travel from the first to
20 the second railway track and from the second to the
21 first railway track.

22
23 According to a second aspect of the present
24 invention there is also provided a method which
25 enables Single Line Working on a second railway
26 track to clear a first railway track for maintenance
27 by other purposes, the method comprising the steps
28 of:-

29 providing a first non-intrusive crossover;
30 providing a second non-intrusive crossover at a
31 location which is spaced apart from the first non-

1 intrusive crossover in the direction of the
2 longitudinal axis of the pair of railway tracks;
3 passing the train along the first non-intrusive
4 crossover;

5 passing the train along the portion of the
6 second railway track between the first and second
7 non-intrusive crossover;

8 passing the train along the second non-
9 intrusive crossover, such that the train is now
10 returned to a location on the first railway track
11 which is spaced apart in the longitudinal direction
12 from the first non-intrusive crossover.

13

14 Typically, the first and/or second non-intrusive
15 crossover comprise a raised track surface, and
16 preferably the raised track surface is provided with
17 a supporting means to allow for passage of trains.

18

19 Typically, each of the first and second non-
20 intrusive crossovers comprise a pair of turnouts,
21 and preferably each pair of turnouts comprise a pair
22 of rails.

23

24 Typically, each rail of the turnout further
25 comprises a ramp surface, wherein, the ramp surface
26 is preferably tapered from a short or no height end
27 to a relatively tall height end. Most preferably,
28 the ramp surface comprises a linear taper from the
29 short or no height end to the relatively tall height
30 end, and preferably the relatively tall height end
31 is of the same height as that of the raised track
32 surface. Typically, the relatively tall height end

1 of the ramp surface is adjacent to an end of the
2 raised track surface, the two combining to provide a
3 path along which the wheel is permitted to travel
4 whilst maintaining a substantially equal distance
5 between a pair of raised rails, which combined, form
6 the raised track surface. Preferably, the ramp
7 surface comprises a ramp for each rail, where both
8 ramps preferably incline simultaneously, typically
9 avoiding differential levels, in relation to the
10 respective rails.

11
12 In a first embodiment, at least a portion of each
13 rail of the raised track surface may comprise a slot
14 formed therein, typically below a rail head portion,
15 wherein the slot may be arranged to lie over or
16 around the rail being crossed and the rail head
17 portion is releasably fixed to the said rail being
18 crossed.

19
20 In a second, and preferred embodiment, at least a
21 portion of each rail of the raised track surface,
22 which typically forms part of a crossing rail, or a
23 switch rail comprises a railhead portion arranged to
24 lie over or around a supporting member which in turn
25 is preferably arranged to lie over or around the
26 rail being crossed. Preferably, the supporting
27 member is arranged with its longitudinal axis being
28 parallel to the rails of the parent rail.
29 Preferably, the supporting member comprises at least
30 an upper supporting member and at least a lower
31 supporting member. Preferably, the upper supporting
32 member is planar and more preferably, the upper

1 surface of the upper supporting member is attached
2 to at least a portion of the lower surface of the
3 raised track.

4 Preferably, at least another portion of the raised
5 track surface, which is typically the ramp surface,
6 is supported by the parent rail and a fixing means.

7

8 Typically, the upper supporting planar member is
9 substantially wider than an existing rail of one of
10 the first and second railway tracks.

11

12 Preferably, the upper supporting planar member is
13 rectangular in shape, and more preferably, is in the
14 form of a plate.

15

16 Preferably, a pair of guide means are provided along
17 at least a portion of the upper supporting member's
18 length. Preferably the guide means run parallel to
19 the upper supporting member's longitudinal axis, and
20 more preferably, project downwardly in order, in
21 use, to straddle an existing rail of the first and
22 second existing railway tracks.

23

24 Preferably, a pair of lower supporting members are
25 provided at either side of at least a portion of the
26 existing rail.

27

28 Preferably, the pair of lower supporting members
29 combine to provide a substantially similar shape,
30 width and position along the existing railway track
31 as the upper supporting member, and are adapted to
32 be releasably engaged thereto and more preferably,

1 releasably fixed thereto, wherein the lower surface
2 of the upper supporting planar member preferably
3 lies on top of the uppermost surface of the lower
4 supporting members.

5

6 Alternatively, the lower supporting members combine
7 to be longer and/or wider than the upper supporting
8 member.

9

10 Preferably, normal running of a train along the
11 first and/or second existing railway track(s) may be
12 allowed, where the train does not travel between the
13 first and second existing railway tracks by removing
14 one or more sections of the crossover from
15 engagement with the first and/or second existing
16 railway tracks. Preferably, the one or more
17 removable sections comprise at least a ramp, a first
18 portion of the raised track surface, at least an
19 upper supporting member, and leaving in place a
20 second portion of the raised track surface, and at
21 least a lower supporting member.

22

23 Typically, at least a portion of the raised track
24 surface, which is preferably the same portion as
25 before, is formed on top of a rail head portion or
26 more particularly when referring to the crossing
27 rail, a raised crossover member, wherein the height
28 of the raised crossover member at least equals, and
29 is preferably greater than, the depth of a flange
30 portion of the wheel of the train.

31

1 Typically, the raised track surface comprises a
2 plurality of rail members, one or more of which
3 comprise a curved radius away from one of the
4 railway tracks towards the other railway track.

5

6 Preferably, the plurality of rail members combine to
7 form a turnout having a substantially continuous
8 rail surface and includes the following components:-

9 a ramp member adapted to raise the train wheel
10 to the raised height;

11 a curved radius rail adapted to urge the train
12 away from one of the railway tracks towards the
13 other railway track;

14 a substantially straight rail adapted to
15 transfer the train from the curved radius rail of
16 one track toward the other track; and

17 a crossover rail adapted to allow the train to
18 pass over the inner rails of the first and second
19 existing railway tracks at the raised height.

20

21 Typically, at least a portion of the raised track
22 surface, such as the substantially straight rail, is
23 supported in the lateral and or vertical direction
24 at a plurality of locations along its length by a
25 support device. Preferably, the support device
26 comprises a plurality of pot sleeper arrangements.

27

28 Preferably, the one or more turnouts are temporary
29 turnouts and more preferably are non-intrusive
30 turnouts.

31

1 According to a third aspect of the present
2 invention, there is provided a pot sleeper for
3 supporting a rail of a railway track, the pot
4 sleeper comprising:-

5 a body having an, in use, substantially planar
6 upper surface onto which rails may be connected;
7 front and rear faces which extend downwardly at
8 an angle to the upper surface, the faces having
9 lower contact edges for contact with the ground; and
10 a pair of side ends which extend downwardly at
11 an angle to the upper surface for a greater distance
12 than the front and rear faces.

13

14 The invention of the third aspect has the advantage
15 that the pair of side ends project, in use, into the
16 ground thereby providing resistance against lateral
17 (side to side) movement of the pot sleeper, whilst
18 the main weight of the pot sleeper, rail and train
19 is borne by the contact edges and/or the underside
20 of the substantially planar upper surface.

21

22 Preferably, said lower contact edges having a
23 greater surface area than the cross-sectional area
24 of the front and rear sides.

25

26 Preferably, the front and rear faces combine with
27 the upper surface to form an inverted 'U' shaped
28 body, whilst the pair of side ends combine to close
29 the longitudinal axis of the 'U' shaped body.

30 Preferably, the body is hollow, where the hollow
31 body may be partially or wholly filled with a
32 filling material and more preferably, the contact

1 edges are formed by lips which project either
2 inwardly or outwardly from the body (preferably
3 outwardly) to provide a greater surface area to the
4 body on the, in use, horizontal plane.

5
6 Typically, the upper surface is provided with a
7 coupling mechanism to permit coupling of the pot
8 sleeper to a rail. Preferably, a connection
9 mechanism is provided to couple a first to a second
10 respective pot sleeper, where the connection
11 mechanism may include a substantially rigid member
12 which extends therebetween. Typically, the
13 substantially rigid member may be arranged to pass
14 underneath the rails of the existing railway track.

15
16 Preferably, the pot sleepers are driven into ground
17 ballast by a mechanical means which may be a
18 vibrating mechanism means. Typically, further
19 ballast or other material may be inserted into the
20 hollow body to maintain/increase the height of the
21 pot sleeper, in use.

22
23 Embodiments of the present invention will now be
24 described, by way of example only, with reference to
25 the accompanying drawings, in which:-

26
27 Fig. 1 is a plan view of a first embodiment of
28 a temporary non-intrusive turnout in accordance with
29 the present invention;

30 Fig. 2 is a plan view of a portion of the
31 turnout of Fig. 1 highlighted as detail 1;

1 Fig. 3a is a cross-sectional view across
2 section B-B of Fig. 2;

3 Fig. 3b is a side view of a portion of the
4 turnout shown in the direction of A-A of Fig. 2;

5 Fig. 4 is a close up view of a G-clamp
6 indicated in Fig. 6 as detail 2;

7 Fig. 5 is a close up view of a G-clamp of Fig.
8 7a indicated as detail 3;

9 Fig. 6 is a cross-sectional view across section
10 C-C of Fig. 1;

11 Fig. 7a is a cross-sectional view across
12 section D-D of Fig. 1;

13 Fig. 7b is a side view of the portion of the
14 turnout shown in Fig. 7a;

15 Fig. 8 is a cross-sectional view across section
16 E-E of Fig. 1;

17 Fig. 9a is a close up plan view of the portion
18 of the turnout indicated in Fig. 1 as detail 4;

19 Fig. 9b is a cross-sectional view across
20 section F-F of Fig. 9a;

21 Fig. 10 is a perspective view of a scale model
22 of a temporary non-intrusive turnout, substantially
23 identical to the embodiment shown in Fig. 1 in
24 accordance with the present invention during
25 installation;

26 Fig. 11 is a perspective view of the turnout
27 section of Fig. 10 further on during construction;

28 Fig. 12 is a perspective view of the turnout
29 section of Fig. 11 further on during construction;

30 Fig. 13 is a perspective view of the turnout
31 section of Fig. 12 further on during construction;

1 Fig. 14 is a plan view of one end of the
2 turnout section of Fig. 13;

3 Fig. 15 is a perspective view of a model
4 representing a train as it enters the turnout
5 section of Fig. 14;

6 Fig. 16 is a perspective view of the model of
7 Fig. 15 as it progresses through the turnout
8 section;

9 Fig. 17 is a perspective view of the model of
10 Fig. 16 as it progresses further through the turnout
11 section;

12 Fig. 18 is a perspective view of the model of
13 Fig. 17 as it nears the end of the turnout section;

14 Fig. 19a is a plan view of an alternative and
15 preferred embodiment of a switch rail to that shown
16 in Fig. 1, where the switch rail is mounted on a
17 support plate;

18 Fig. 19b is a cross-sectional view of the
19 switch rail of Fig. 19a;

20 Fig. 19c is a plan view of the switch rail and
21 support plate of Fig. 19a;

22 Fig. 19d is a side view of the support plate of
23 Fig. 19a;

24 Fig. 19e is a side view of an end of the switch
25 rail of Fig. 19a;

26 Fig. 19f is an end view of the end of the
27 switch rail of Fig. 19e;

28 Fig. 20a is a plan view of an alternative
29 embodiment of crossing rail to that shown in Fig. 1;

30 Fig. 20b is a cross-sectional view of the
31 crossing rail of Fig. 20a;

1 Fig. 20c is a side view of an end of the
2 crossing rail of Fig. 20a;

3 Fig. 20d is an end view of the end of the
4 crossing rail of Fig. 20c;

5 Fig. 21a is a plan view of the crossing rail of
6 Fig. 20a as it crosses an existing rail of a railway
7 track;

8 Fig. 21b is a cross-sectional view of the
9 crossing rail taken through the line A-A of Fig.
10 21a;

11 Fig. 21c is a plan view of the crossing rail of
12 Fig. 21a without the existing rail for clarity;

13 Fig. 21d is a side view of the crossing rail of
14 Fig. 21c;

15 Figs. 22a, b, c and d are side views of
16 possible/optional gutt rail deflecting means for use
17 with a gutt rail of the turnout of Fig. 1;

18 Fig. 23a is a plan view of level crossing
19 support members for supporting the switch rail of
20 Fig. 19a;

21 Fig. 23b is a cross-sectional view of level
22 crossing support members of Fig. 23a;

23 Fig. 23c is a detailed plan view of level
24 crossing support members which is an alternative
25 embodiment for supporting the crossing rails of the
26 turnout of Fig. 1;

27 Fig. 23d is a cross-sectional view of the level
28 crossing support members and the crossing rail of
29 Fig. 23c;

30 Fig. 23e is an plan overview showing the
31 position of the level crossing support members of
32 Fig. 23c within the crossover;

1 Fig. 24a is a perspective view of a further
2 alternative and preferred embodiment of a turnout in
3 accordance with the present invention;

4 Fig. 24b is a plan view of the switch rail and
5 ramp rails and associated level crossing support
6 members of the turnout of Fig. 24a;

7 Fig. 24c is a perspective view of the temporary
8 turnout of Fig. 24a, also showing an arrangement of
9 pot sleepers in accordance with a third aspect of
10 the present invention;

11 Fig. 25a is a side view of the ramp rails
12 leading onto the switch rails of the turnout of Fig.
13 24a;

14 Fig. 25b is side view showing one of the train
15 wheels mid-way up the ramp rail of Fig. 25a;

16 Fig. 26 is a perspective view showing the ramp
17 rail and clamping mechanism;

18 Figs. 27a and 28a are perspective view
19 photographs showing the crossing rail of Fig. 24a
20 during installation;

21 Figs. 29a, b, c, d are end view photographs
22 showing the train wheels passing a portion of the
23 support members of Fig. 24b during normal running;

24 Fig. 29a and 29f show the support members and
25 gutt rails of Fig. 29a in position during normal
26 running;

27 Fig. 29g is a perspective view showing the
28 support members of Fig. 29a prior to installation;

29 Fig. 30 is a perspective view showing the train
30 passing over the crossing rails of Fig. 29a, whilst
31 clearing the main tracks;

1 Fig. 31a and 31b are perspective view
2 photographs taken during installation of the ramp
3 rails and switch rails of Fig. 29a;

4 Fig. 32a is a plan view showing the layout of
5 the pot sleepers of Fig. 24c;

6 Fig. 32b is a plane view showing two pot
7 sleeper arrangements of Fig. 24c connected by a
8 rigid frame;

9 Fig. 32c shows an end, side, and plan view of
10 the pot sleeper arrangement of Fig. 24c;

11 Fig. 33a is a perspective view showing the pot
12 sleeper and rigid frame arrangements of Fig. 32b in
13 their operational position;

14 Fig. 33b is a perspective view of the pot
15 sleeper arrangement of Fig. 24c with a sample rail
16 section fixed thereto;

17 Fig. 34a is side view of the pot sleeper
18 arrangement of Fig. 24c with a sample rail section
19 fixed thereto;

20 Fig. 34b is a perspective view showing the pot
21 sleeper arrangement and switch rail of Fig. 24c in
22 their operational positions;

23 Fig. 35a and 35b are perspective view
24 photographs showing the layout of the pot sleeper
25 arrangements of Fig. 24c.

26

27 Fig. 1 shows a non-intrusive turnout generally
28 indicated as 10 in accordance with a first
29 embodiment of the present invention. It will be
30 appreciated by the reader that two spaced apart non-
31 intrusive turnouts 10 are utilised on a section of
32 track to provide a non-intrusive crossover.

1
2 As shown in Fig. 1, the temporary non-intrusive
3 turnout 10 links a south bound rail track 12 and a
4 north bound rail track 14, such that a train (not
5 shown) which has already been transferred from the
6 south bound rail track 12 to travel south along the
7 north bound rail track 14 can be transferred back
8 onto the south bound rail track 12. In this manner,
9 the portion of the south bound rail track 12' can be
10 repaired/maintained. The skilled reader will
11 realise that other routes of transfer could be
12 installed and adopted.

13
14 The temporary non-intrusive turnout 10 comprises a
15 number of components which will now be described.

16
17 The non-intrusive turnout 10 comprises a pair of
18 turnout tracks 16, 18 and a plurality of temporary
19 sleepers 20. For ease of reference, the turnout
20 track 16 will be referred to as the left hand
21 turnout track 16 and the turnout track 18 will be
22 referred to as the right hand turnout track 18.

23
24 The left hand turnout track 16 comprises, from the
25 left hand end of Fig. 1, a ramp rail 22L. The
26 uppermost portion of the ramp rail 22L is wedge
27 shaped, with the uppermost surface tapering linearly
28 from its left most end which has a height of 0mm up
29 to its right most end which has a height of
30 approximately 50mm and this linear tapering can be
31 best seen in Figs. 7B, 25A and 25B which shows that
32 the ramp rail 22 has a sufficient length, in the

1 region of 1700mm, such that the angle of tapering is
2 relatively gradual. The ramp rail 22L is coupled to
3 the north bound left hand rail track 14L by means of
4 a G-clamp mechanism 32 as shown in Fig. 5; it should
5 be noted however that other types of clamp
6 mechanisms could be utilised. The ramp rail 22
7 comprises a head portion 51 which rests on top of
8 the upper flat surface of the rail track 12, 14. A
9 neck portion 53 extends downwardly from the inner
10 most edge of the head portion 51, where the neck
11 portion 53 is shaped to substantially match the
12 shape of the inside face of the rail track 12, 14.

13
14 The G-clamp mechanism 32 comprises a G-shaped clamp
15 34, one end of which surrounds and is compressed
16 against, the opposite upstanding face of the rail
17 track 12, 14 to the neck portion 53. A vice 36
18 extends toward the neck portion 53 of the ramp rail
19 22 from the other end of the G-shaped clamp 34, such
20 that the vice 36 can be forced or urged into secure
21 connection with the neck portion 53. Preferably,
22 the vice 36 is of a type that can be readily
23 assembled and disassembled in a short amount of
24 time.

25
26 Following on from the ramp rail 22L from left to
27 right, the left hand turnout track 16 next comprises
28 a switch rail 24L, the left hand most end of which
29 is arranged to butt against the right hand most end
30 of the ramp rail 22L, as shown in Fig. 7b. As shown
31 in Fig. 6, the switch rail 24L, 24R comprises a
32 respective head portion 55L, 55R and the switch rail

1 24L, 24R is inwardly curved along its length, toward
2 the south bound rail track 12 and thus away from the
3 north bound rail track 14. In other words, the end
4 of the switch rail 24L adjacent to the ramp rail 22L
5 is located directly above the north bound rail track
6 14L whilst the opposite end of the switch rail 24L
7 is displaced from the north bound rail track 14L.
8 Nevertheless, the head portion 55L comprises a
9 linear height of approximately 50mm arranged
10 horizontally along its length. The switch rail 24L
11 also comprises a neck portion 57L. Conveniently,
12 and as shown in Fig. 4, the neck portion 57L may
13 have a slot formed in it at the end of the switch
14 rail 24L closest to the ramp rail 22L, such that the
15 upper most portion of the north bound rail track 14L
16 can protrude inwardly through said slot.
17 Alternatively, the slot may be omitted, with the
18 neck portion 57L following the shape of the inside
19 face of the north bound rail track 14L. The switch
20 rail 24L is secured in a releasable fashion to the
21 north bound rail track 14L by means of a G-clamp
22 mechanism 62 which operates in a similar fashion to
23 the G-clamp mechanism 32 of Fig. 5. The G-clamp
24 mechanism 62 as shown in Fig. 4 comprises a similar
25 G-shaped clamp 64 and a vice 66. The switch rail
26 24L is supported at its middle and right hand most
27 end from underneath by the G-clamp mechanism 62 and
28 temporary sleepers 20. It should be noted that the
29 term "inside face" is used in the sense that it is
30 the face that the respective turnout track 16, 18 is
31 being turned away from.
32

1 Following on from the switch rail 24L from left to
2 right, the left hand turnout track 16 next comprises
3 a gutt rail 26L. The gutt rail 26L has an I-shaped
4 cross-section which is broadly similar to the I-
5 shaped cross-section of a normal rail track such as
6 12, 14. The gutt rail 26L continues to bend at
7 approximately the same radius as the bend radius of
8 the switch rail 24L. The clamping mechanism of the
9 gutt rail 26L to the north bound rail track 14L is
10 similar to that as shown in Fig. 8 which will be
11 described subsequently. Again, the gutt rail 26L is
12 supported from underneath by the clamping mechanism
13 and temporary sleepers 20 to have its upper flat
14 horizontal surface to be approximately 50mm above
15 the south bound 12 and hence north bound 14 rail
16 tracks.

17
18 Up until this point, the right hand turnout track 18
19 substantially mirrors that of the left hand turnout
20 track 16, since the right hand turnout track 18
21 comprises, from left to right in Fig. 1, a ramp rail
22 22R, a switch rail 24R and a gutt rail 26R.

23
24 The left hand turnout track 16 from left to right
25 after the gutt rail 26L comprises a straight rail
26 28L which thus has no bend radius and which once
27 again is supported by the temporary sleepers 20 to
28 have its upper flat horizontal surface to be
29 approximately 50mm above the south bound 12 and
30 hence north bound 14 rail tracks.

31

1 Following immediately on from the straight rail 28L,
2 the left hand turnout track 16 comprises a crossing
3 rail 30L which is broadly similar to the crossing
4 rail 30R which will be described subsequently.

5
6 Immediately following on from the gutt rail 26R, the
7 right hand turnout track 18 comprises a crossing
8 rail 30R which is shown in more detail in Fig. 2 and
9 Figs. 3A and 3B. The crossing rail 30R comprises a
10 substantially I-shaped cross-section toward and at
11 both its ends which is substantially the same I-
12 shaped cross-section as the existing south bound 12
13 and north bound 14 rail track. Thus, towards and at
14 its ends, the crossing rail 30R comprises a head
15 portion 59 and a neck portion 61. However, a slot
16 or gap 31 is provided along a portion of the length
17 of the crossing rail 30R about the mid point of the
18 crossing rail 30R such that there is no neck portion
19 61 in the region of the slot 31 as shown most
20 clearly in Fig. 3B. The crossing rail 30R is
21 arranged to lie across the north bound rail track
22 14L such that the north bound rail track 14L lies
23 within the slot 31. Accordingly, since the crossing
24 rail 30R is again supported from underneath by the
25 temporary sleepers 20 to have its head portion 59
26 with a height of approximately 50mm and since the
27 crossing rail 30R is arranged to be horizontal, the
28 upper most surface of the crossing rail 30R is
29 approximately 50mm higher than the upper most
30 surface of the south bound 12 and north bound 14
31 rail tracks.

32

1 The right hand turnout track 18 next comprises from
2 left to right and immediately after the crossing
3 rail 30R, a straight rail 28R which is substantially
4 identical in function and arrangement to the
5 straight rail 28L previously described. Similarly,
6 the crossing rail 30L is substantially identical to
7 the crossing rail 30R in function and arrangement
8 except that the crossing rail 30L crosses over the
9 south bound rail track 12R.

10 The left hand turnout track 16 follows on from left
11 to right after the crossing rail 30L with a gutt
12 rail 42L which is followed by a switch rail 44L
13 which is in turn followed by a ramp rail 46L which
14 are respectively substantially identical to the gutt
15 rails 26L, switch rail 24L and ramp rail 22L in
16 function and arrangement.

17
18 The right hand turnout track 18 follows on from the
19 straight rail 28R from left to right with a gutt
20 rail 22R which is followed by a switch rail 44R
21 which is in turn followed by a ramp rail 46R which
22 are respectively substantially identical in function
23 and arrangement to the gutt rail 26R, the switch
24 rail 24R and the ramp rail 22R.

25
26 As shown in Fig. 8, the gutt rails 42L, 42R (and
27 thus the gutt rails 26L, 26R) are clamped to the
28 south bound rail tracks 12L, 12R by means of a J
29 block arrangement 68L, 68R and a lengthened G-clamp
30 mechanism 70L, 70R. The J block arrangement 68L and
31 G-clamp mechanism 70L will now be described, but
32 those skilled in the art will realise that the J

1 block arrangement 68R and G-clamp mechanism 70R are
2 substantially identical to the J block arrangement
3 68L and G-clamp mechanism 70L except that they are
4 rotated through 180°. The gutt rail 42L is spaced
5 apart from the south bound rail track 12L by means
6 of the J block arrangement 68L which is preferably
7 formed from any hard material that is shaped to fit
8 into the heart of the rail to maintain a set
9 distance between the rails. As shown in Fig. 8, the
10 J block arrangement 68L is arranged such that it not
11 only spaces the gutt rail 42L horizontally apart
12 from the south bound rail track 12L but it also
13 spaces them vertically apart, such that the upper
14 most horizontally arranged surface of the gutt rail
15 42L is approximately 50mm vertically above the upper
16 most horizontally arranged surface of the south
17 bound rail track 12L. The G-clamp mechanism 70L
18 clamps the gutt rail 42L to the south bound rail
19 track 12L via the J block arrangement 68L and the G-
20 clamp mechanism 70L once again comprises a vice 76L
21 or a bolted fixing through the rail 12L, 42L and J
22 block arrangement 68L or similar arrangement.

23

24 It should be noted that, as shown in Fig. 9A, the
25 left hand 16 and right hand 18 turnout tracks may be
26 provided with a pot sleeper arrangement 80, where
27 the two pot sleeper arrangements 80L, 80R are
28 coupled to one another via a rigid frame 82L, 82R,
29 where the rigid frame 82L, 82R may be provided in
30 two halves, 82L, 82R which are coupled to one
31 another at their outer most ends via a suitable
32 fixing means 84 such as nuts and bolts (not shown).

1 Thus, the pot sleeper arrangement 80L, 80R can be
2 used either to replace the temporary sleepers 20 (as
3 shown in Figs. 32A and 33A) or could be provided on
4 top of an in-situ or existing timber sleeper, in
5 order to provide increased rigidity to the non-
6 intrusive temporary turnout 10.

7
8 The pot sleeper arrangement 80 is shown in more
9 detail in Figs. 33B and 34A with a sample rail
10 section 86 fixed in position. The beam section 84
11 of the pot sleeper 80 has a hollow, inverted U-
12 shaped cross section which is toed out at the
13 lowermost end of each side of the inverted, U-shape
14 to form lips 88. End plates 90 are attached to each
15 end of the beam section 84 such that each end plate
16 90 protrudes vertically downward past the lips 88,
17 the downward projection typically being in the
18 region of 100mm. The sample rail section 86 is
19 connected to the beam section 84 by conventional
20 'Pandrol' clips 92 which are known widely in the
21 railway industry.

22
23 When the pot sleepers 80 are in position, the end
24 plates 90 project into the ballast or stones(not
25 shown in Fig. 33B) until the lips 88 are level with
26 the ballast (not shown). This projection of the
27 plates 90 provides increased lateral stability to
28 the pot sleepers 80 in both the longitudinal and
29 perpendicular directions with respect to the main
30 axis of the pot sleepers 80, whilst keeping the mass
31 of the pot sleeper arrangement 80 to a minimum. The
32 lips 88 also create a larger surface area or

1 footprint for the pot sleeper 80 which avoids it
2 sinking into the ballast (not shown) beyond a
3 satisfactory depth when a load is placed on the pot
4 sleeper 80 (i.e. during the passing of a train 5).

5
6 Fig. 10 shows a scale model of a non-intrusive
7 turnout 10 part way through construction; it should
8 be noted however that the scale model shown in Fig.
9 10 omits the straight rails 28L, 28R and also the
10 switch rails 44L, 44R but it is envisaged that the
11 straight 28L, 28R and switch 44L, 44R rails would be
12 used in a full size rail track 12, 14.

13
14 Fig. 10 shows that a couple of temporary sleepers 20
15 have been laid, and the gutt rails 42L, 42R have
16 been secured to the temporary sleepers 20 and also
17 secured to the south bound track 12L, 12R. It
18 should also be noted that the gutt rails 42R are in
19 essence longer versions of the switch rails 44L, 44R
20 in the model shown in Fig. 10 through Fig. 18. The
21 crossover rail 30L has also been installed such that
22 it crosses over the south bound rail track 12R.

23 Fig. 11 shows that the gutt/switch rail 26L has been
24 installed next and is followed by installation of
25 the gutt/switch rail 26R in Fig. 12 and is followed
26 by the crossover rail 30R as shown in Fig. 13.

27 Thereafter, the ramp rails 22L, 22R are secured to
28 the respective north bound rail tracks 14L, 14R.

29
30 A model of a train 5 is shown in Fig. 15 as having
31 travelled south along the north bound rail track 14
32 and having mounted the ramp rails 22L, 22R. It is

1 important to note that the ramp rails 22L, 22R raise
2 the wheels of the train (not shown) and thus the
3 model train 5 by an amount sufficient such that the
4 flanged part of the wheel is just vertically above
5 the height of the rest of the normal track 14L, 14R.
6 Thus, and as shown in Fig. 16, when the model train
7 5 moves onto the crossing rails 30L, 30R, the left
8 hand 16 and right hand 18 turnout tracks are of a
9 sufficient height such that the flanged part of the
10 wheel 7, which normally acts to keep the model train
11 5 and thus full size trains on the tracks, is able
12 to clear the north bound rail track 14L and then the
13 south bound rail track 12R. The model 5 is shown in
14 Fig. 17 as continuing through the non-intrusive
15 temporary turnout 10 until it reaches the position
16 shown in Fig. 18 which shows the model 5 about to
17 travel down the ramp rails 46L, 46R and then onward
18 as per normal south along the south bound rail track
19 12.

20
21 The embodiment of the non-intrusive turnout 10
22 described herein has the great advantage that the
23 rail tracks 12R and 14L do not require to be cut
24 which would be normal if a conventional intrusive
25 temporary turnout was to be inserted in to the
26 tracks 12, 14. Furthermore, those skilled in the
27 art will appreciate that, if a train requires to
28 pass through the non-intrusive temporary turnout 10
29 without actually crossing over from one track 12
30 onto another track 14, the ramp rails 22 or 46 as
31 required can be removed along with the respective
32 switch rails 24 or 44 and crossing rail 30L or 30R

1 and as such the train will be able to bypass the
2 non-intrusive temporary turnout 10.

3

4 A non-intrusive turnout in accordance with an
5 alternative and preferred embodiment of the present
6 invention will now be described with reference to
7 Figs. 19 to 35.

8

9 The sequence of rail components length wise along
10 the track of the turnout of Figs. 19 to 35 is the
11 same as that for the previous embodiment (Fig. 1)
12 i.e. from the left hand end of the left hand turnout
13 track 16, a pair of ramp rails 21, 22 followed by a
14 pair of switch rails 23, 24 followed by a pair of
15 gutt rails 25, 26, followed by a pair of crossing
16 rails 29, 30 etc.

17

18 The ramp rails 21, 22 and the means of connecting
19 the ramp rails 21, 22 (G-clamp mechanism 32,
20 represented by 32 in Fig. 26) in this embodiment are
21 broadly similar to that of the previous embodiment,
22 and thus require no further description.

23

24 Following on from the ramp rails 21, 22, Figs 19A
25 and B along with Figs. 24A, B , C) shows a pair of
26 switch rail units generally designated 100
27 comprising a switch rail head 50, planar member or
28 plate 38, guide means 60 in the form of downwardly
29 projecting guide flanges 60, a pair of supporting
30 members 40, end plate 72, and support connecting
31 means 48 in the form of clips 48.

32

1 The switch rail head 50 essentially takes the form
2 of an upper portion of an I-shaped rail section
3 (shown during installation of the apparatus in Figs.
4 31A and B), and extends between one end of the
5 switch rail unit 100 and the other. The switch rail
6 head 50 is inwardly curved along its length toward
7 the south bound rail track 12 and thus away from the
8 north bound rail track 14, in a broadly similar
9 manner to the previous embodiment (Fig. 1).

10

11 The planar member or plate 38 is rectangular in
12 dimension and is permanently attached to the switch
13 rail head 50 by any suitable means during
14 manufacture such as welding or moulding etc. The
15 plate 38 may or may not extend along the full length
16 of the switch rail unit 100; in the latter case, the
17 switch rail head 50 will overhang the plate member
18 38. This is best seen in Figs. 27A and 28A.

19

20 The pair of guide flanges 60 project downwardly from
21 the plate 38 and run parallel to the existing north
22 bound track 14 along the entire length of the switch
23 rail unit 100 and are displaced from the centreline
24 or the plate 38 by an amount which allows the inner
25 track of the existing north bound track 14 to fit
26 closely between the pair of guide flanges 60. The
27 skilled reader will realise that the guide flanges
28 60 may only be present at the extreme ends of the
29 plate 38.

30

31 Each supporting member 40 may be a wooden timber and
32 has a cross sectional shape which allows them to be

1 placed underneath the plate 38 and close around the
2 inner and outer neck portions of the existing rail.
3 The lower surface of each supporting member 40
4 together may also be adapted, during manufacture or
5 upon installation, to match the contours of a
6 variety of standard railway sleepers. The pair of
7 supporting members 40 are of a length, width and
8 position, substantially similar to that of the
9 plate 38, though it will be appreciated that longer
10 and or wider supporting members may be preferable
11 depending upon the individual situation parameters,
12 for example the alignment and or size of the gaps
13 between sleepers.

14
15 The clips 48 releasably attach the pair of
16 supporting members 40 to the plate 38, and are
17 designed such that they will hold the supporting
18 members 40 firmly against the planar member 38 in
19 the vertical direction, and against the existing
20 rail in the lateral direction.

21
22 The end plate 72 protrudes vertically downward from
23 the overhang created by the switch rail head 50 and
24 butts against the end of the inner supporting member
25 40.

26
27 It will be appreciated by the reader that in this
28 embodiment the supporting members 40 may be left in
29 position during normal running of the railway track
30 (as shown in Figs. 29A, B, C, D, E and F); that is
31 when no transfer of trains between one railway track
32 and another is required, so that there is no

1 crossover of a train 5 travelling on either north
2 bound track 14 or south bound track 12.
3 Alternatively the supporting members 40 may be
4 placed to one side ready for installation as shown
5 in Fig. 29G. Therefore in this embodiment of the
6 invention the switch rail head 50 and planar member
7 38 may be installed and removed with relative ease
8 and in a relatively short amount of time as desired.

9
10 Following on from the switch rail unit 100 the
11 turnout next comprises a pair of gutt rails 25, 26.
12 The gutt rails 25, 26 in this embodiment are broadly
13 similar to that of the previous embodiment, and thus
14 require no further description.

15
16 Following on from the gutt rails 25, 26, the turnout
17 next comprises a pair of crossing units generally
18 designated 200 (Figs. 20A, B and Fig. 30). Each
19 crossing unit 200 comprising a crossing rail head
20 50c, planar crossing member or plate 38c, guide
21 flanges 60c, a pair of supporting members 40c, a
22 pair of end plates 72c, and support connecting clip
23 48c.

24
25 The crossing rail head 50c has the same cross
26 sectional shape as that of the switch rail 50, (i.e.
27 upper portion of an I-shaped rail section), and
28 extends diagonally between one end of the crossing
29 unit 200 and the other, so as to point toward the
30 south bound track 12 and thus away from the north
31 bound track 14.

32

1 The crossing rail head 50c may span a longer
2 distance along the crossing unit 200 than the
3 crossing plate 38c and the supporting members 40c,
4 thus creating an overhang at either or both ends of
5 the crossing unit 200.

6
7 The crossing plate 38c, guide flanges 60c,
8 supporting members 40c, and support connecting
9 clips 48c are broadly similar to those of the switch
10 rail unit 100, and thus require no further
11 description.

12
13 The pair of end plates 72c protrude vertically
14 downward from the overhang created by the crossing
15 rail head 50c. Each end plate butts against the end
16 of a supporting member 40c.

17
18 The end plates 72 of the switch rail head 50, and
19 the end plates 72c of the crossing rail head 50c may
20 be drilled to suit a standard connecting means such
21 as a fishplate, in order to provide a secure
22 connection between each rail head component.

23
24 The non-intrusive turnout 10 described in this
25 embodiment has an advantage over the previous
26 embodiment of additional support to the turnout
27 track which is provided by the supporting members
28 40, 40c whilst still allowing the switch rail head
29 50, crossing rail 50c, plate 38, and crossing plate
30 38c to be removed and installed relatively easily,
31 without permanent alteration (i.e. cutting) of the
32 existing track.

1
2 Fig. 21A and B show the crossing unit of a non-
3 intrusive turnout in accordance with a further
4 alternative embodiment of the present invention,
5 which will now be described.

6
7 A partially supported crossing unit generally
8 designated 300 comprises a crossing rail head 50d,
9 and a tapered supporting member 40d.

10
11 The crossing rail head 50d is broadly similar to
12 that of the previous embodiments e.g. 50c and thus
13 requires no further description.

14
15 The tapered supporting member 40d is wedge shaped
16 such that it fits in the gap created between the
17 crossing rail 50d and the existing rail near the
18 point of crossing over.

19
20 For each of the previously described embodiments,
21 when the ramp rails 21, 22, switch rails 23, 24, and
22 crossing rails 29, 30 are removed it is preferable
23 that the end of each gutt rail 25, 26 exposed to an
24 oncoming train is provided with deflecting means
25 which deflect any loose items (not shown) suspended
26 below the railway carriage (not shown) away from the
27 gutt rails 25, 26, thereby preventing such items
28 from snagging on the gutt rails 25, 26 which could
29 otherwise result in derailment of the railway
30 carriage. Figs. 21A, B, C and D show possible
31 deflecting means for this purpose. Each deflecting
32 means is adapted to be easily fitted onto the

1 exposed end of the gutt rails 25, 26 by suitable
2 means, for example a fishplate. Prior to re-
3 installation of the ramp rails 21, 22, switch rails
4 23, 24, and crossing rails 29, 30, the deflecting
5 means will be removed.

6
7 Fig. 23A and B show supporting means for a switch
8 rail and crossing unit of a non-intrusive turnout in
9 accordance with a further alternative embodiment of
10 the present invention, which will now be described.

11
12 Central level crossing support members 40e known and
13 used in the industry are wedged between the existing
14 rails and are supported by central supports 78c
15 which are connected to the existing sleeper 79. The
16 central level crossing support members 40e are
17 complimented by outer level crossing support members
18 400e which are supported by outer supports 78o.
19 Positioned between the outer level crossing support
20 members 400e and the inner level crossing support
21 members 40e are outer packing wedges 120 and inner
22 packing wedges 121. The outer and inner packing
23 members 120, 121 secure the level crossing members
24 40e, 400e in both the lateral and vertical
25 directions.

26
27 The switch rail head 50e and planar member 38e are
28 broadly similar to that described previously (Fig.
29 19) and are situated above the level crossing
30 support members 40e and 400e.

31

1 A similar adaptation is shown in Figs. 23C and D
2 making use of the level crossing supports 40e and
3 400e in the crossing rail unit.

4
5 This support arrangement has the advantage over
6 previous embodiments of the invention in that it
7 allows the loads exerted by the passing train to be
8 transferred directly to the sleeper and existing
9 rail, whilst using currently available components.

10
11 It should be noted that embodiments of the present
12 invention offer a number of advantages over previous
13 apparatus for transferring trains from one track to
14 another, namely but not exclusively that, the
15 crossover is non-intrusive, there is no requirement
16 for the train wheel to run on the flange at any
17 point, and that the embodiments do not require a
18 pivotable section to effect the transfer, thereby
19 decreasing the likelihood of malfunction of the
20 apparatus, and that the simultaneous incline of the
21 ramps avoids twisting occurring to the train
22 axles/bogies as they run up the ramps.

23
24 Modifications and improvements may be made to the
25 embodiments described herein without departing from
26 the scope of the invention. For instance, the
27 height of approximately 50mm of the various
28 components of the non-intrusive temporary turnout 10
29 can be varied to suit the flanges provided on the
30 wheels of trains in different countries and may be
31 adapted to accommodate various track gauges. Those
32 skilled in the art will realise that the height of

1 the various components simply needs to be equal to,
2 or more preferably just slightly higher than the
3 extent of the flange provided on the wheels of
4 trains in each particular country.

5

1 CLAIMS

2

3 1. A turnout apparatus for a railway track, the
4 turnout apparatus comprising a raised track surface
5 which is adapted to provide a path along which
6 wheels of a train can travel from one railway track
7 to another, wherein the raised track surface is of a
8 sufficient height such that the wheels of the train
9 are arranged to clear the said railway tracks.

10

11 2. Apparatus according to claim 1, wherein a
12 crossover comprising a pair of said turnouts is
13 provided.

14

15 3. Apparatus according to either of claims 1 or 2,
16 wherein the raised track surface comprises a pair of
17 rails, each rail further comprising a ramp surface
18 which is tapered from a short or no height end to a
19 relatively tall height end.

20

21 4. Apparatus according to claim 3, wherein the
22 ramp surface comprises a linear taper from the short
23 or no height end to the relatively tall height end.

24

25 5. Apparatus according to claims 3 or 4, wherein
26 the relatively tall height end is of the same height
27 as that of the raised track surface.

28

29 6. Apparatus according to any of claims 3 to 5,
30 wherein the relatively tall height end of the ramp
31 surface is adjacent to an end of the raised track
32 surface, the two combining to provide a path along

1 which the wheel is permitted to travel whilst
2 maintaining a substantially equal distance between a
3 pair of raised rails, which combined, form the
4 raised track surface.

5
6 7. Apparatus according to any of claims 3 to 6,
7 wherein the ramp surface comprises a ramp for each
8 rail, where both ramps incline simultaneously,
9 avoiding differential levels, in relation to the
10 respective rails of the said railway tracks.

11
12 8. Apparatus according to any of claims 3 to 6,
13 wherein at least a portion of each rail of the
14 raised track surface comprises a slot formed
15 therein.

16
17 9. Apparatus according to claim 8, wherein the
18 slot is formed below a rail head portion, wherein
19 the slot is arranged to lie over or around the rail
20 of the said railway track being crossed and the rail
21 head portion is releasably fixed to the said rail
22 being crossed.

23
24 10. Apparatus according to any of claims 1 to 7,
25 wherein at least a portion of each rail of the
26 raised track surface comprises a railhead portion
27 arranged to lie over or around a supporting member.

28
29 11. Apparatus according to claim 10, wherein the
30 supporting member is arranged to lie over or around
31 the rail of the said railway track being crossed.

32

1 12. Apparatus according to either of claims 10 or
2 11, wherein the supporting member comprises a
3 longitudinal axis which is arranged parallel to a
4 longitudinal axis of the said rail of the railway
5 track.

6
7 13. Apparatus according to any of claims 10 to 12,
8 wherein the supporting member comprises at least an
9 upper supporting member and at least a lower
10 supporting member.

11
12 14. Apparatus according to claim 13, wherein the
13 upper supporting member is planar.

14
15 15. Apparatus according to either of claims 13 or
16 14, wherein an upper surface of the upper supporting
17 member is attached to at least a portion of a lower
18 surface of the raised track.

19
20 16. Apparatus according to any preceding claim,
21 wherein at least a portion of the raised track
22 surface is supported by the said rail of the railway
23 track being crossed and a fixing means.

24
25 17. Apparatus according to claim 14 or to either of
26 claims 15 or 16 when dependent upon claim 14,
27 wherein the upper supporting planar member is
28 substantially wider than the said rail of the
29 railway track being crossed.

30

1 18. Apparatus according to claim 17, wherein the
2 upper supporting planar member comprises a
3 rectangular place member.
4

5 19. Apparatus according to claim 13 or to any of
6 claims 14 to 18 when dependent upon claim 13,
7 wherein a pair of guide means are provided along at
8 least a portion of the upper supporting member's
9 length.
10

11 20. Apparatus according to claim 19, wherein the
12 guide means run parallel to the upper supporting
13 member's longitudinal axis, and project downwardly
14 in order, in use, to straddle the said rail of
15 railway track being crossed.
16

17 21. Apparatus according to claims 13 or to any of
18 claims 14 to 20 when dependent upon claim 13,
19 wherein a pair of lower supporting members are
20 provided at either side of at least a portion of the
21 said rail of the railway track being crossed.
22

23 22. Apparatus according to claim 21, wherein the
24 pair of lower supporting members combine to provide
25 a substantially similar shape, width and position
26 along the said rail of the railway track being
27 crossed as the upper supporting member, and are
28 adapted to be releasably engaged thereto and
29 releasably fixed thereto.
30

31 23. Apparatus according to claim 14 or to any of
32 claims 15 to 22 when dependent upon claim 13,

1 wherein a lower surface of the upper supporting
2 planar member lies on top of an uppermost surface of
3 the lower supporting members.

4
5 24. Apparatus according to any preceding claim,
6 wherein at least a portion of the raised track
7 surface is formed on top of a rail head portion,
8 wherein the height of a crossover member of the
9 raised track surface at least equals the depth of a
10 flange portion of the wheel of the train.

11
12 25. Apparatus according to any preceding claim,
13 wherein the raised track surface comprises a
14 plurality of rail members, one or more of which
15 comprise a curved radius away from one of the
16 railway tracks towards the other railway track.

17
18 26. Apparatus according to claim 25, wherein the
19 plurality of rail members combine to form a turnout
20 having a substantially continuous rail surface and
21 includes the following components:-

22 a ramp member adapted to raise the train wheel
23 to the raised height;

24 a curved radius rail adapted to urge the train
25 away from one of the railway tracks towards the
26 other railway track;

27 a substantially straight rail adapted to
28 transfer the train from the curved radius rail of
29 one track toward the other track; and

30 a crossover rail adapted to allow the train to
31 pass over the inner rails of the first and second
32 existing railway tracks at the raised height.

1 27. Apparatus according to any preceding claim,
2 wherein at least a portion of the raised track
3 surface is supported in the lateral and/or vertical
4 direction at a plurality of locations along its
5 length by a support device.

6

7 28. Apparatus according to claim 27, wherein the
8 support device comprises a plurality of pot sleeper
9 arrangements.

10

11 29. Apparatus according to any preceding claim,
12 wherein the one or more turnouts are temporary
13 turnouts.

14

15 30. Apparatus according to any preceding claim,
16 wherein the one or more turnouts are non-intrusive
17 turnouts.

18

19 31. A method of allowing normal running of a train
20 along one of a first and second existing railway
21 track(s), having a crossover installed, in
22 accordance with claim 2 or any of claims 3 to 30
23 when dependent upon claim 2, comprising;

24 removing one or more sections of the crossover
25 from engagement with the said one of the first and
26 second existing railway track(s), such that the
27 train does not travel onto the other of the said
28 first and second existing railway tracks.

29

30 32. A method according to claim 31 further
31 comprising;

1 leaving in place a second portion of the raised
2 track surface, and at least a lower supporting
3 member.

4
5 33. A method of transferring a train from one
6 railway track to a second railway track, the method
7 comprising the steps of:-

8 providing a raised track surface which is
9 adapted to provide a path along which wheels of the
10 train can travel from the first to the second
11 railway track;

12 passing the train along the first track and
13 onto the raised track surface, wherein the raised
14 track surface is of a sufficient height such that
15 the wheels of the train are arranged to clear at
16 least one of the first and second railway tracks.

17
18 34. Apparatus for facilitating Single Line Working
19 on a second railway track to clear a first railway
20 track for maintenance or other purposes, the
21 apparatus comprising a first non-intrusive crossover
22 and a second non-intrusive crossover being spaced
23 apart from the first non-intrusive crossover in the
24 direction of the longitudinal axis of the pair of
25 railway tracks, and which provide a path along which
26 wheels of a train can travel from the first to the
27 second railway track and from the second to the
28 first railway track.

29
30 35. Apparatus according to claim 34, wherein the
31 first and/or second non-intrusive crossover comprise
32 a raised track surface.

1 36. Apparatus according to claim 35, wherein the
2 raised track surface is provided with a supporting
3 means to support the passage of trains.
4

5 37. Apparatus according to any of claims 34 to 36,
6 wherein each of the first and second non-intrusive
7 crossovers comprise a pair of turnouts, and each
8 pair of turnouts comprise a pair of rails.
9

10 38. A method which enables Single Line Working on a
11 second railway track to clear a first railway track
12 for maintenance by other purposes, the method
13 comprising the steps of:-

14 providing a first non-intrusive crossover;
15 providing a second non-intrusive crossover at a
16 location which is spaced apart from the first non-
17 intrusive crossover in the direction of the
18 longitudinal axis of the pair of railway tracks;
19 passing the train along the first non-intrusive
20 crossover;

21 passing the train along the portion of the
22 second railway track between the first and second
23 non-intrusive crossover;

24 passing the train along the second non-
25 intrusive crossover, such that the train is returned
26 to a location on the first railway track which is
27 spaced apart in the longitudinal direction from the
28 first non-intrusive crossover.
29

30 39. A pot sleeper for supporting a rail of a
31 railway track, the pot sleeper comprising:-

1 a body having an, in use, substantially planar
2 upper surface onto which rails may be connected;
3 front and rear faces which extend downwardly at
4 an angle to the upper surface, the faces having
5 lower contact edges for contact with the ground; and
6 a pair of side ends which extend downwardly at
7 an angle to the upper surface for a greater distance
8 than the front and rear faces.

9
10 40. A pot sleeper according to claim 39, wherein
11 said lower contact edges have a greater surface area
12 than the cross-sectional area of the front and rear
13 sides.

14
15 41. A pot sleeper according to either of claims 39
16 or 40, wherein the front and rear faces combine with
17 the upper surface to form an, in use, inverted 'U'
18 shaped body, whilst the pair of side ends combine to
19 close the longitudinal axis of the 'U' shaped body.

20
21 42. A pot sleeper according to claims 39 to 42,
22 wherein the body is hollow which is adapted to be at
23 least partially filled with a filling material.

24
25 43. A pot sleeper according to claims 39 to 42,
26 wherein the upper surface is provided with a
27 coupling mechanism to permit coupling of the pot
28 sleeper to a rail.

29
30 44. A pot sleeper according to claims 39 to 43,
31 wherein a connection mechanism is provided to couple
32 a first to a second respective pot sleeper, where

1 the connection mechanism includes a substantially
2 rigid member which extends therebetween.

3

4 45. A pot sleeper according to claim 44, wherein
5 the substantially rigid member is arranged to pass
6 underneath the rails of an existing railway track.

7

8 46. A method of installing and/or maintaining a pot
9 sleeper according to any of claims 39 to 45 in
10 ground ballast comprising;

11 driving the pot sleeper into the ground ballast
12 by mechanical vibrating mechanism means.

13

14 47. A method of installing and/or maintaining a pot
15 sleeper in ground ballast according to claim 46
16 comprising;

17 inserting further ballast or other material
18 into the hollow body of the pot sleeper to at least
19 establish the height of the pot sleeper, in use.

20

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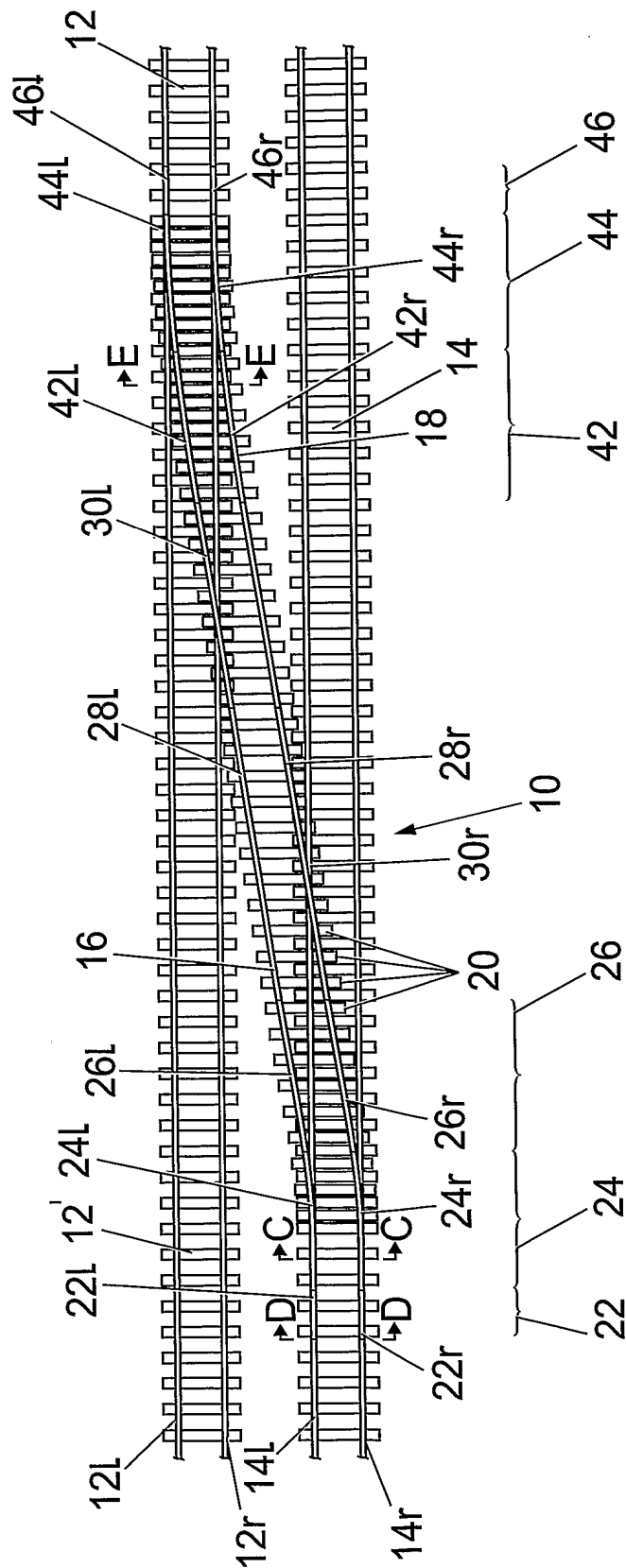
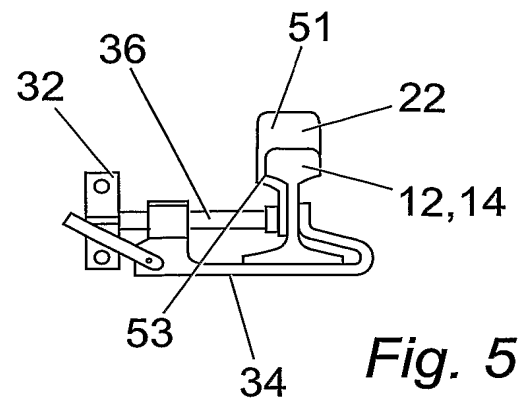
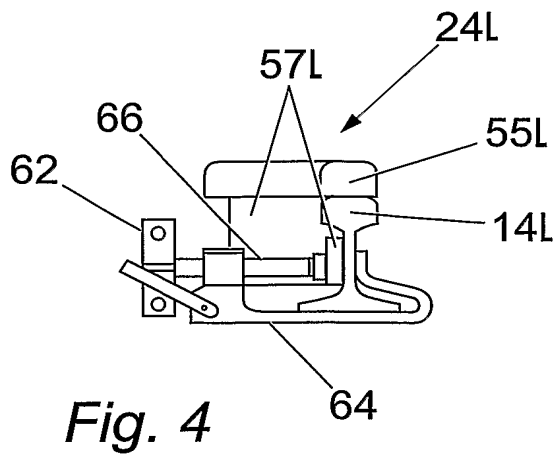
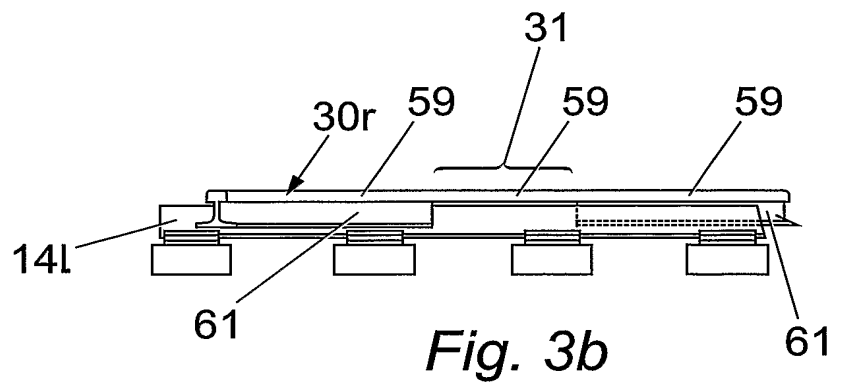
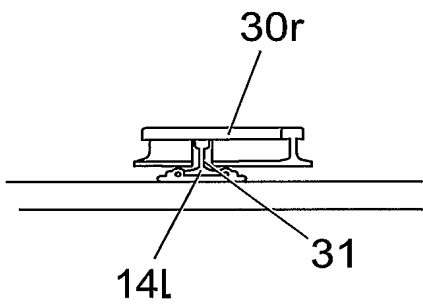
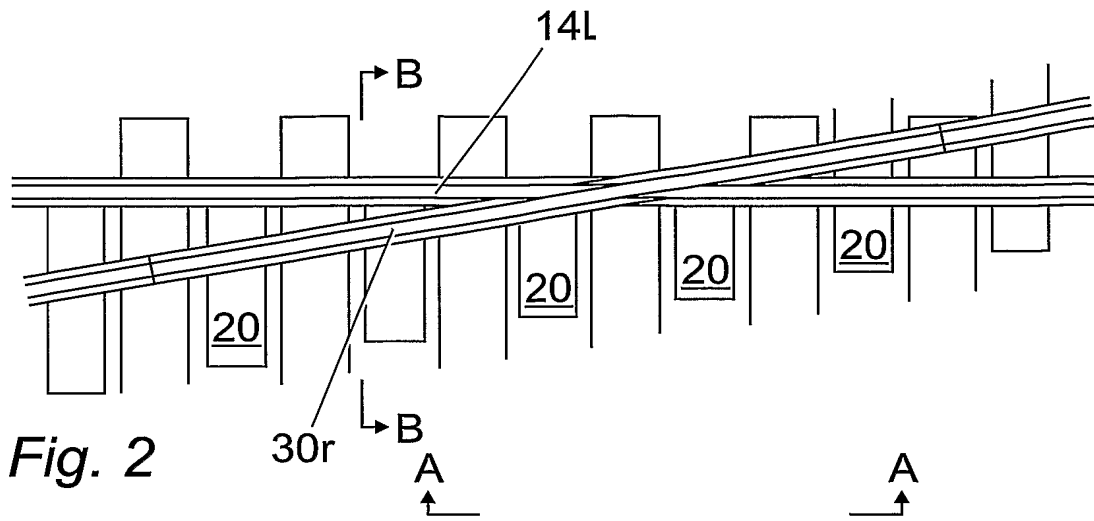


Fig. 1

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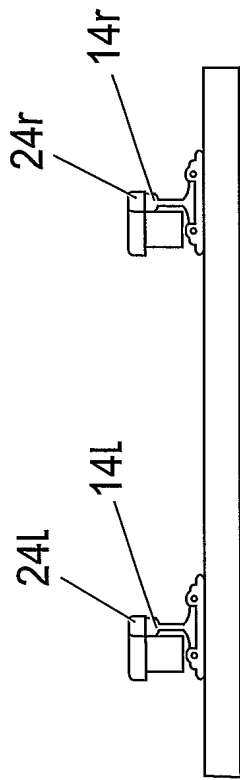


Fig. 6

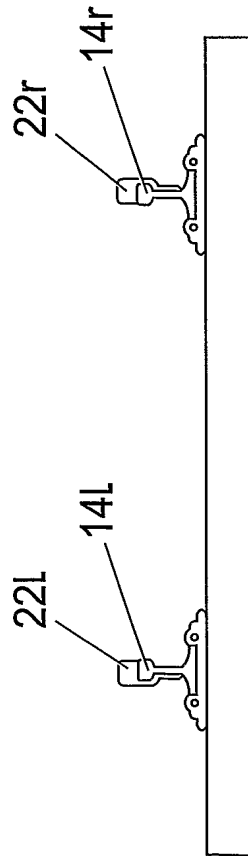


Fig. 7a

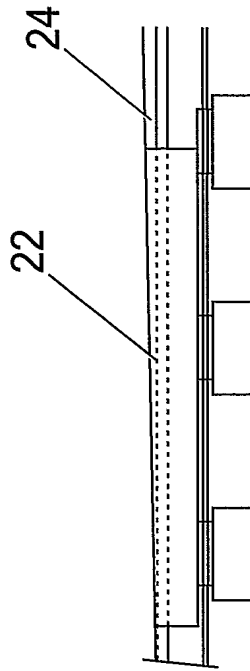


Fig. 7b

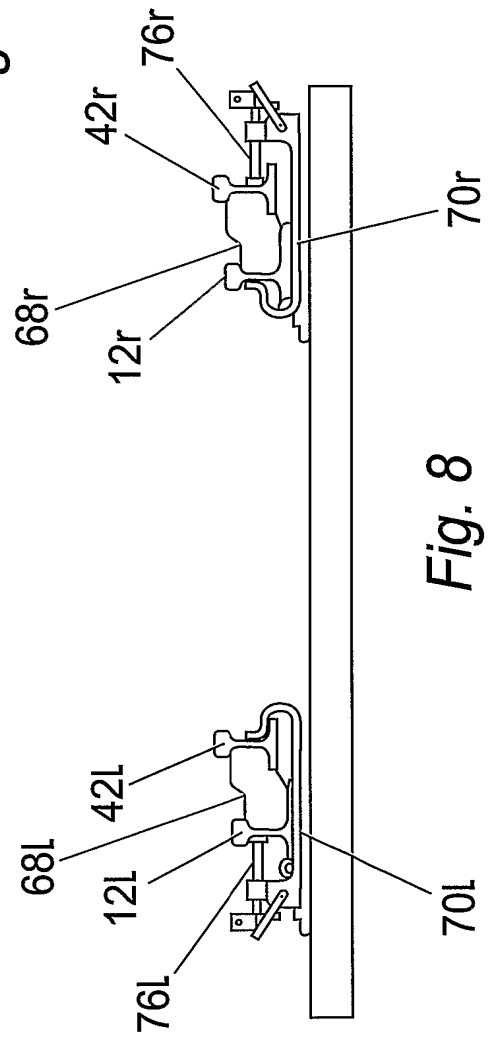
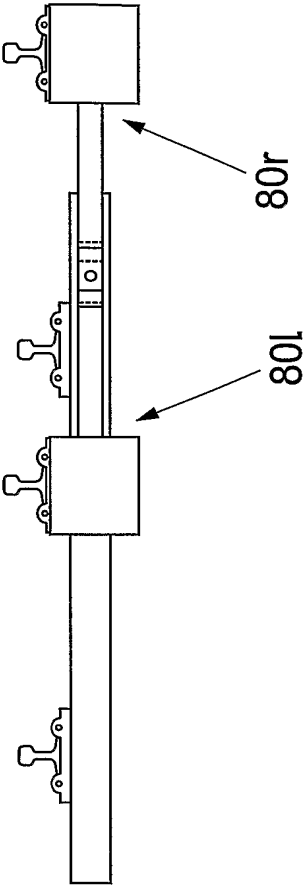
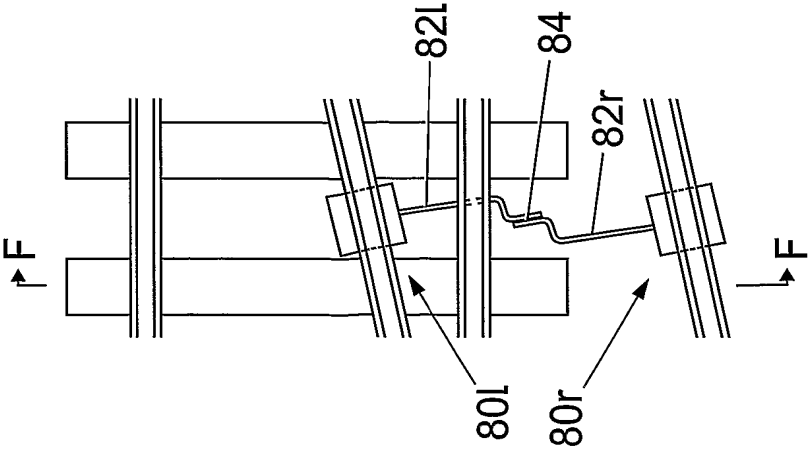


Fig. 8



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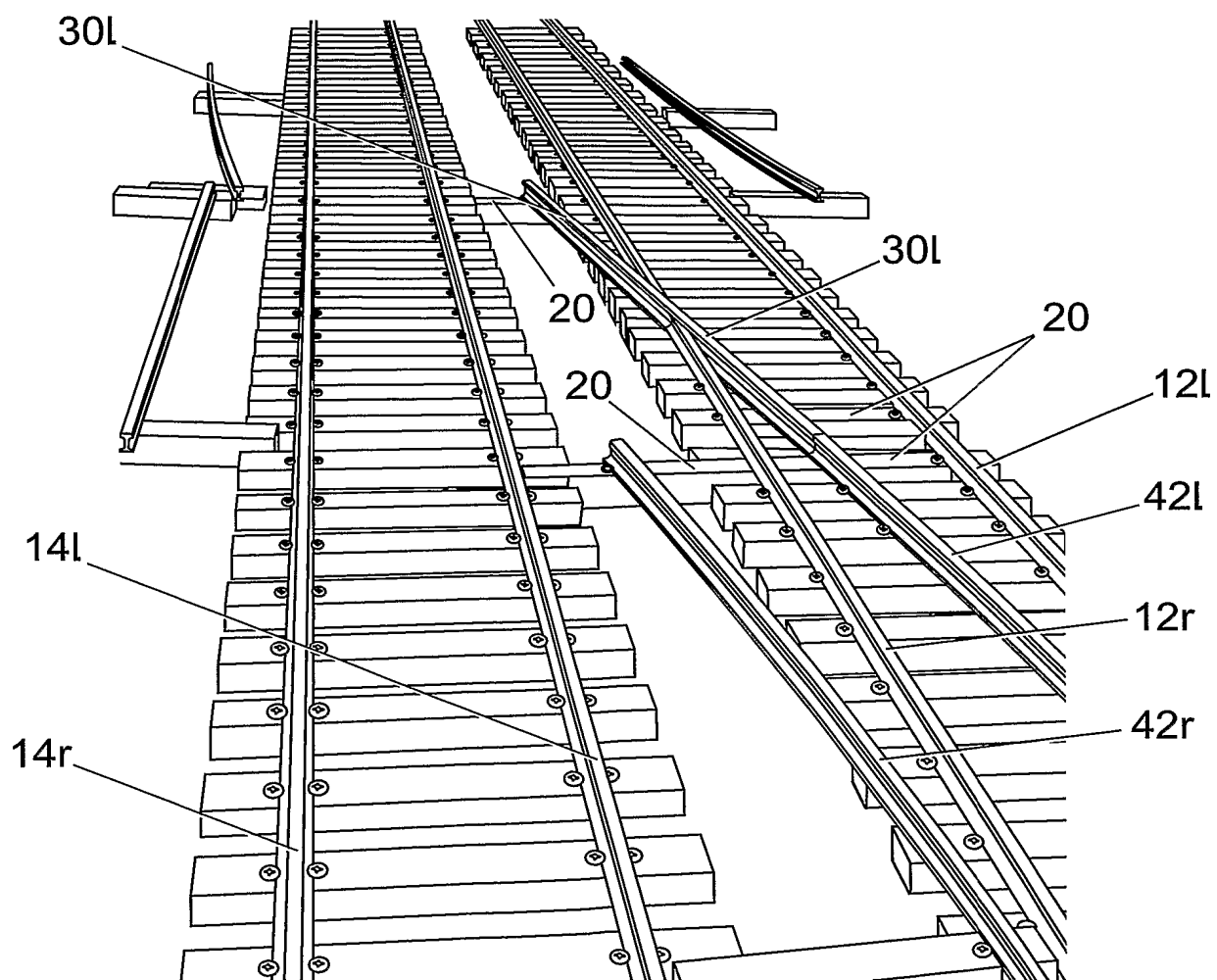


Fig. 10

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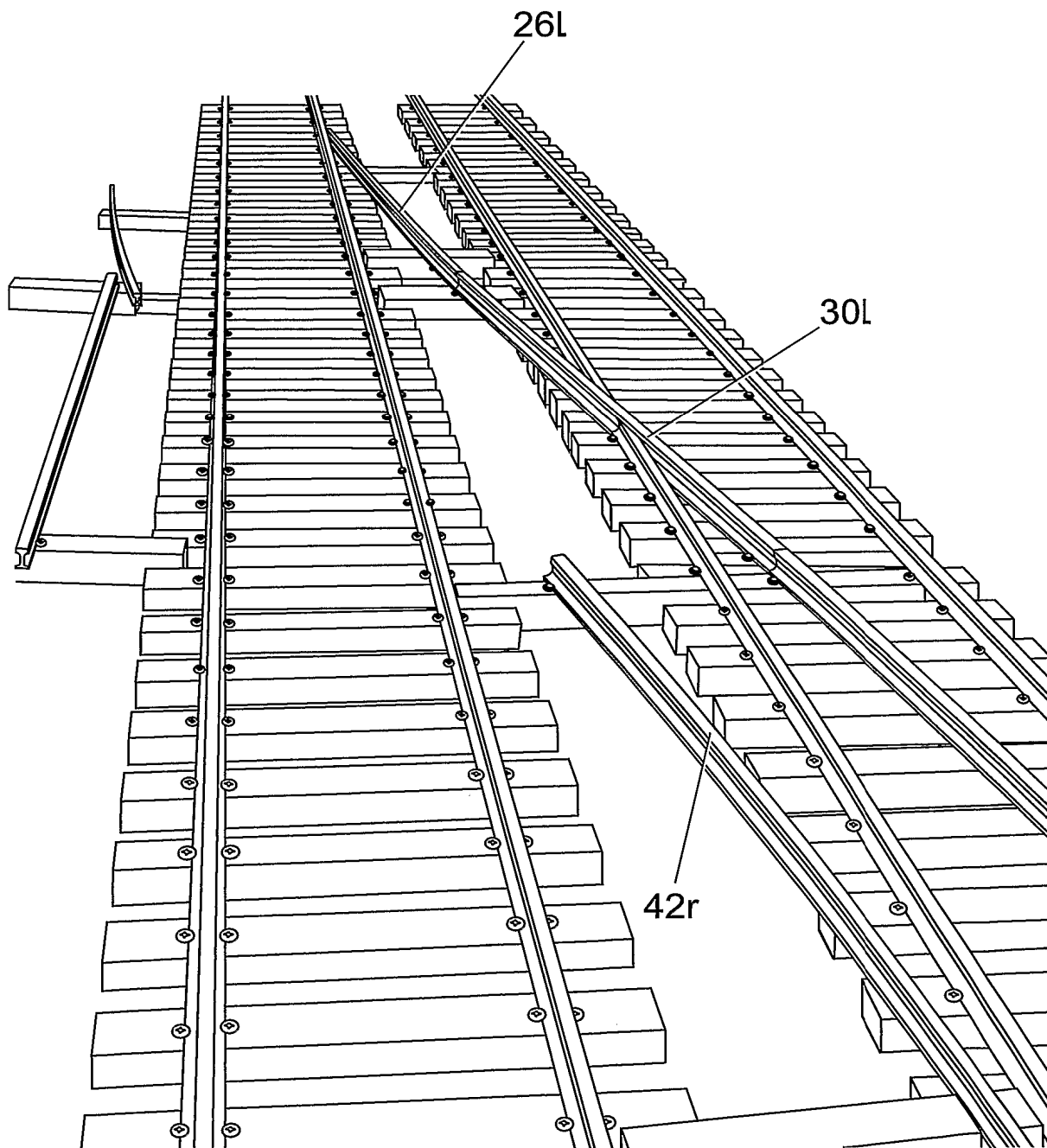


Fig. 11

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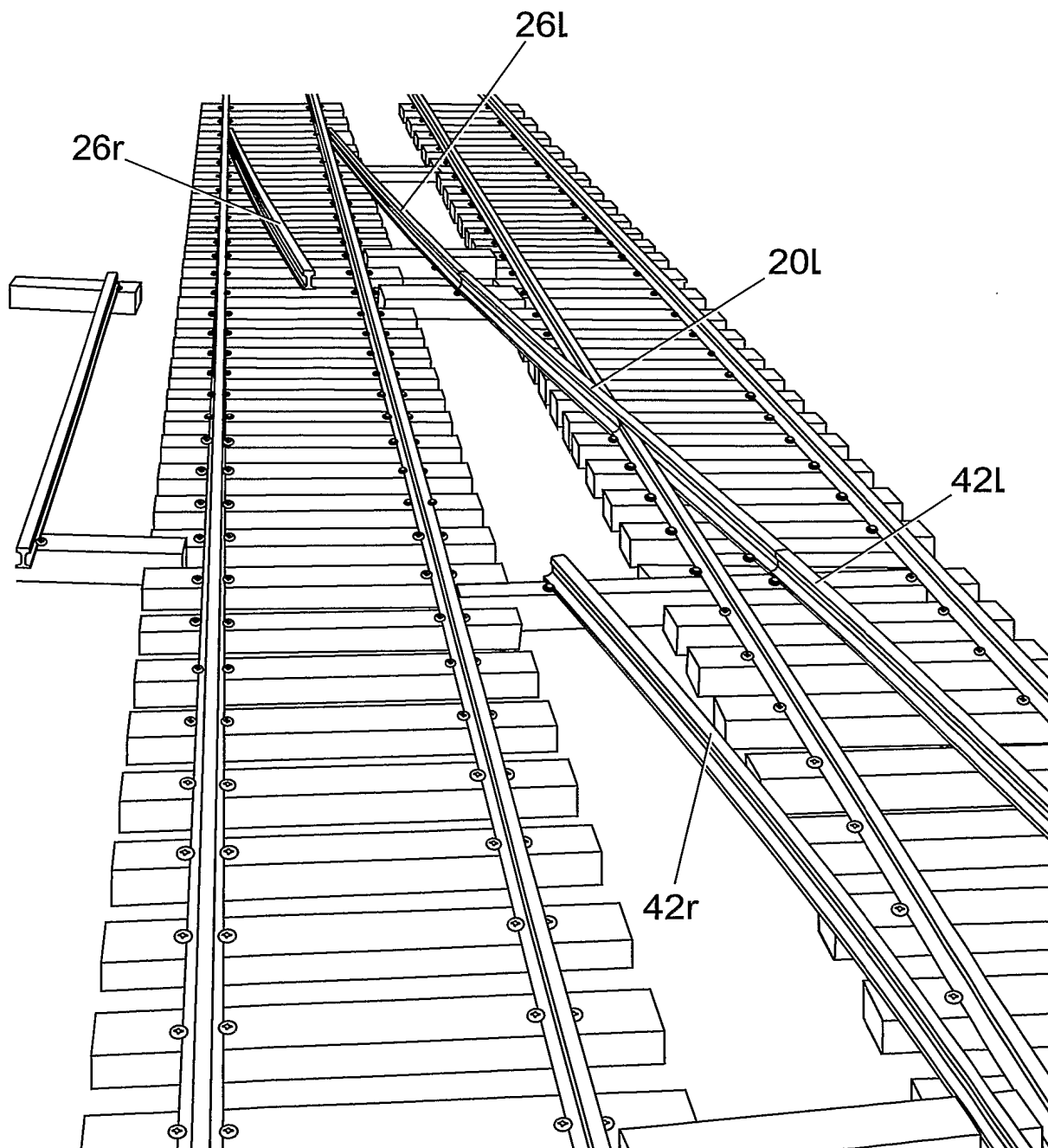


Fig. 12

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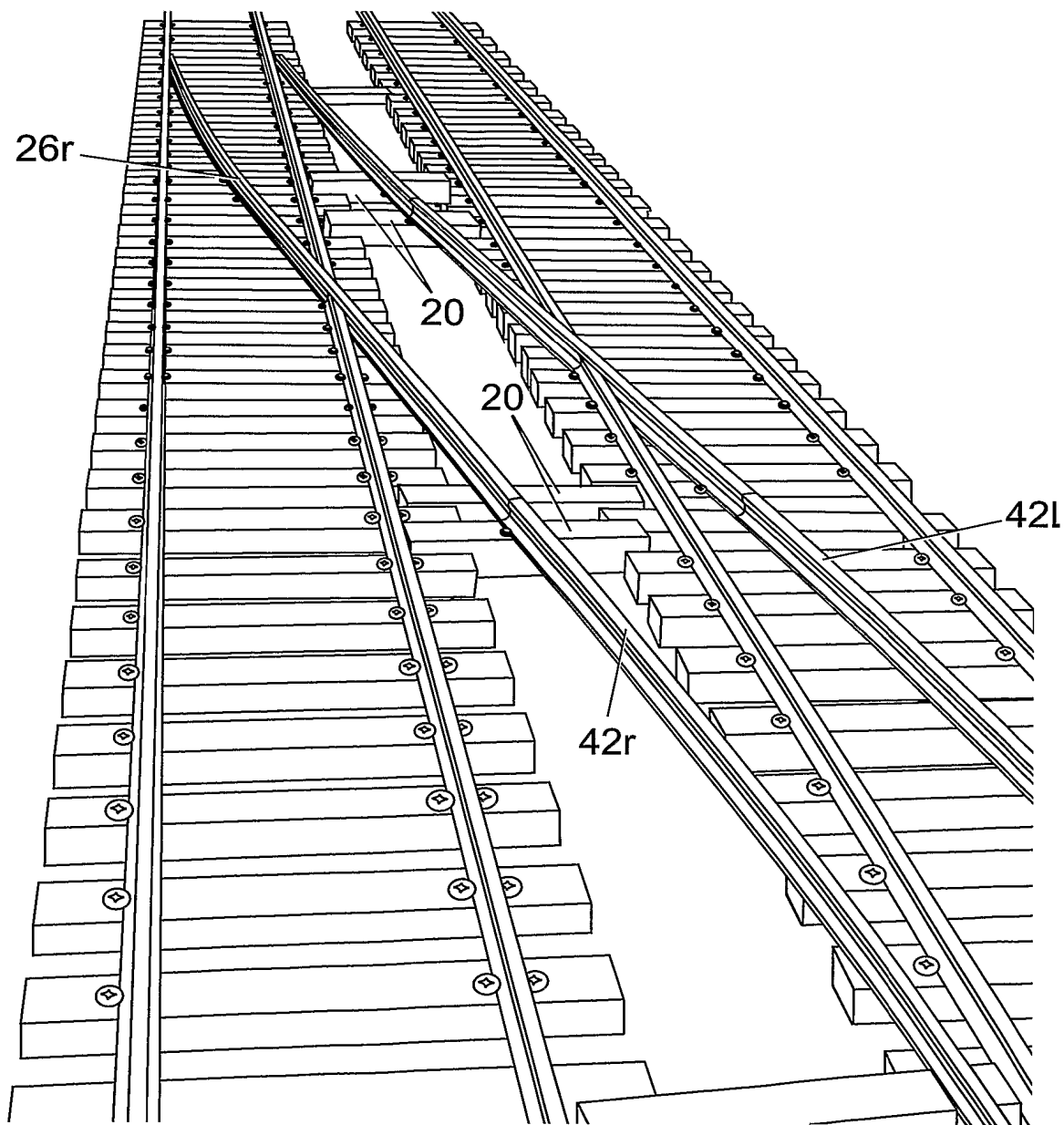


Fig. 13

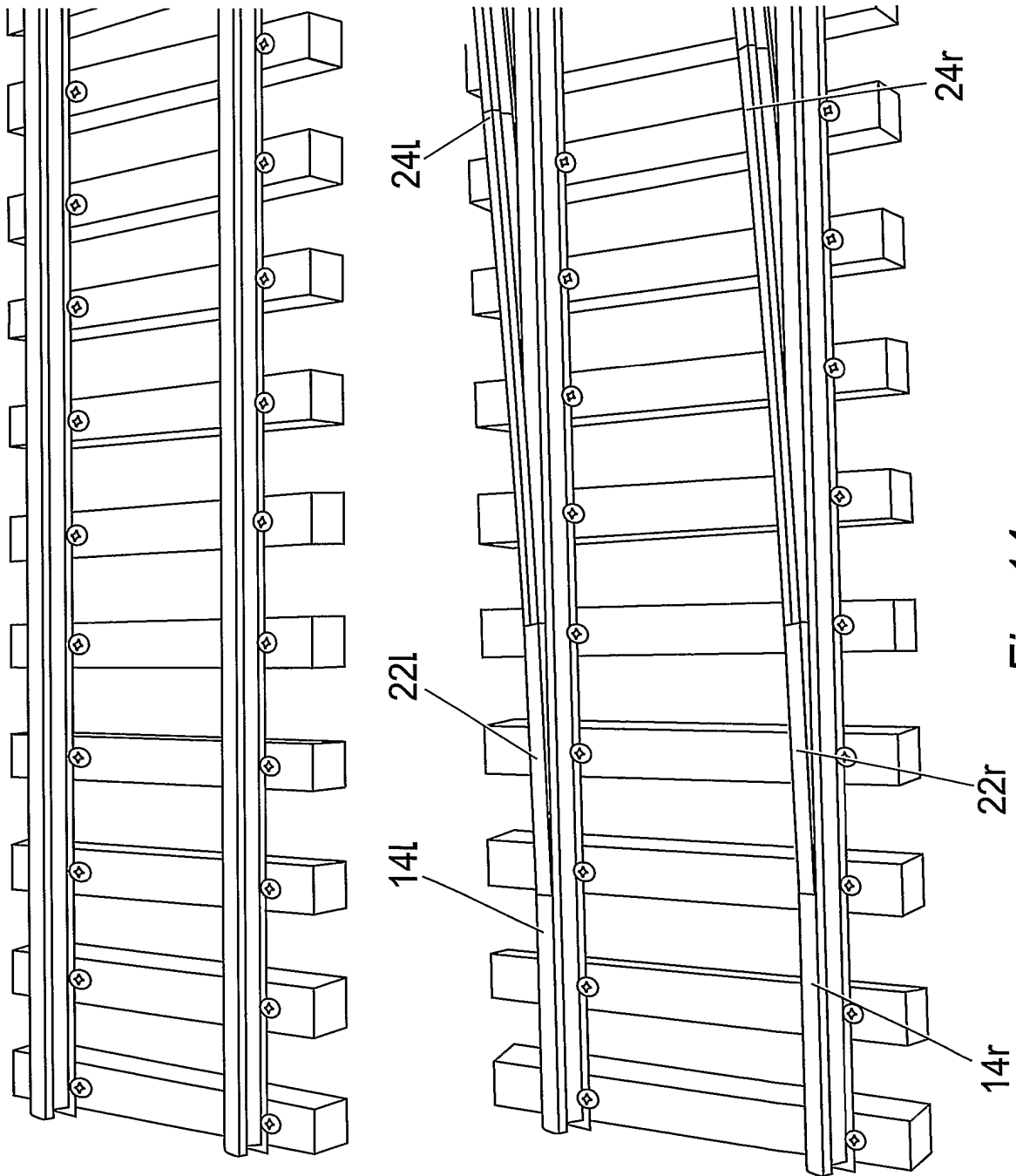


Fig. 14

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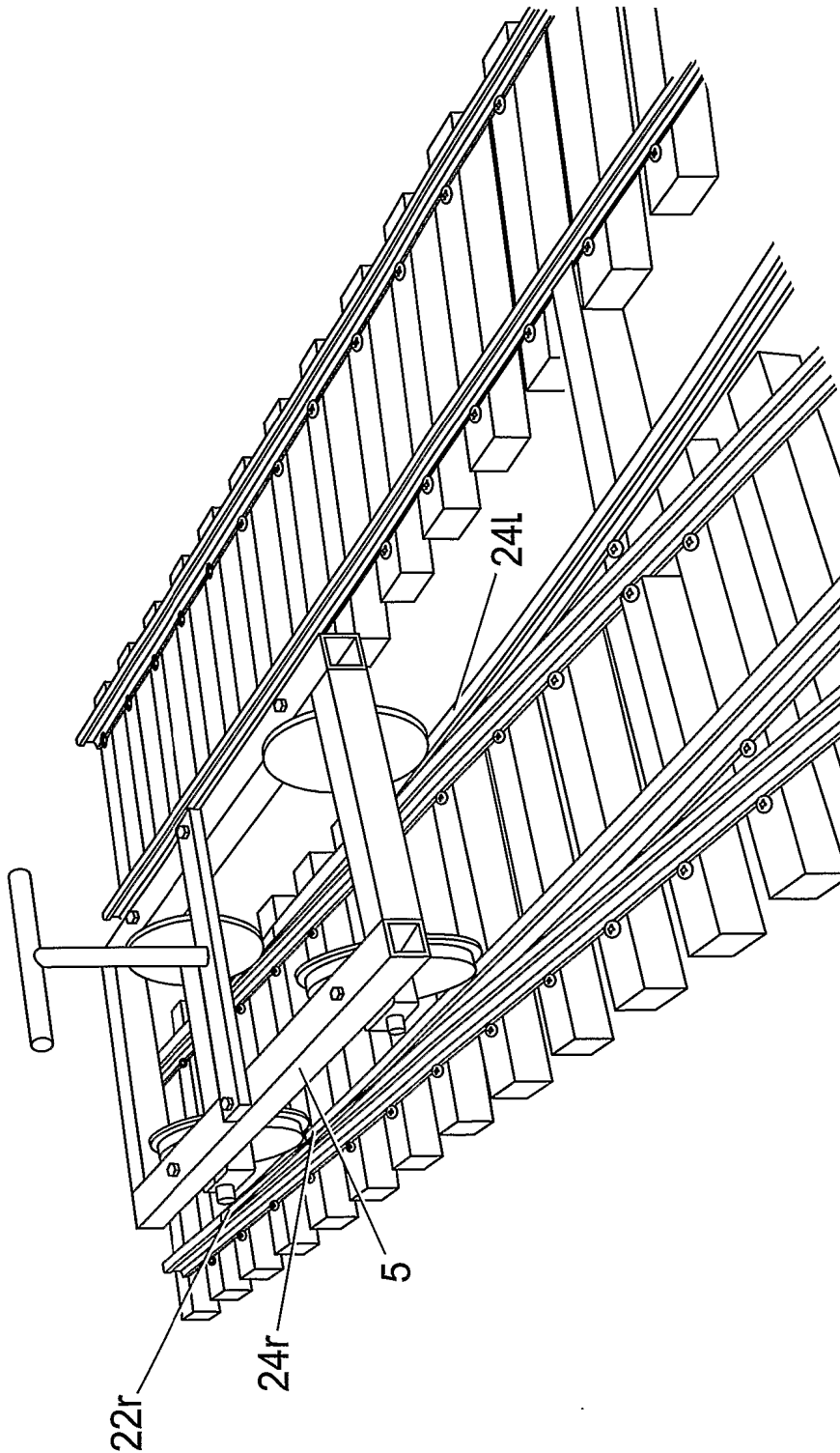


Fig. 15

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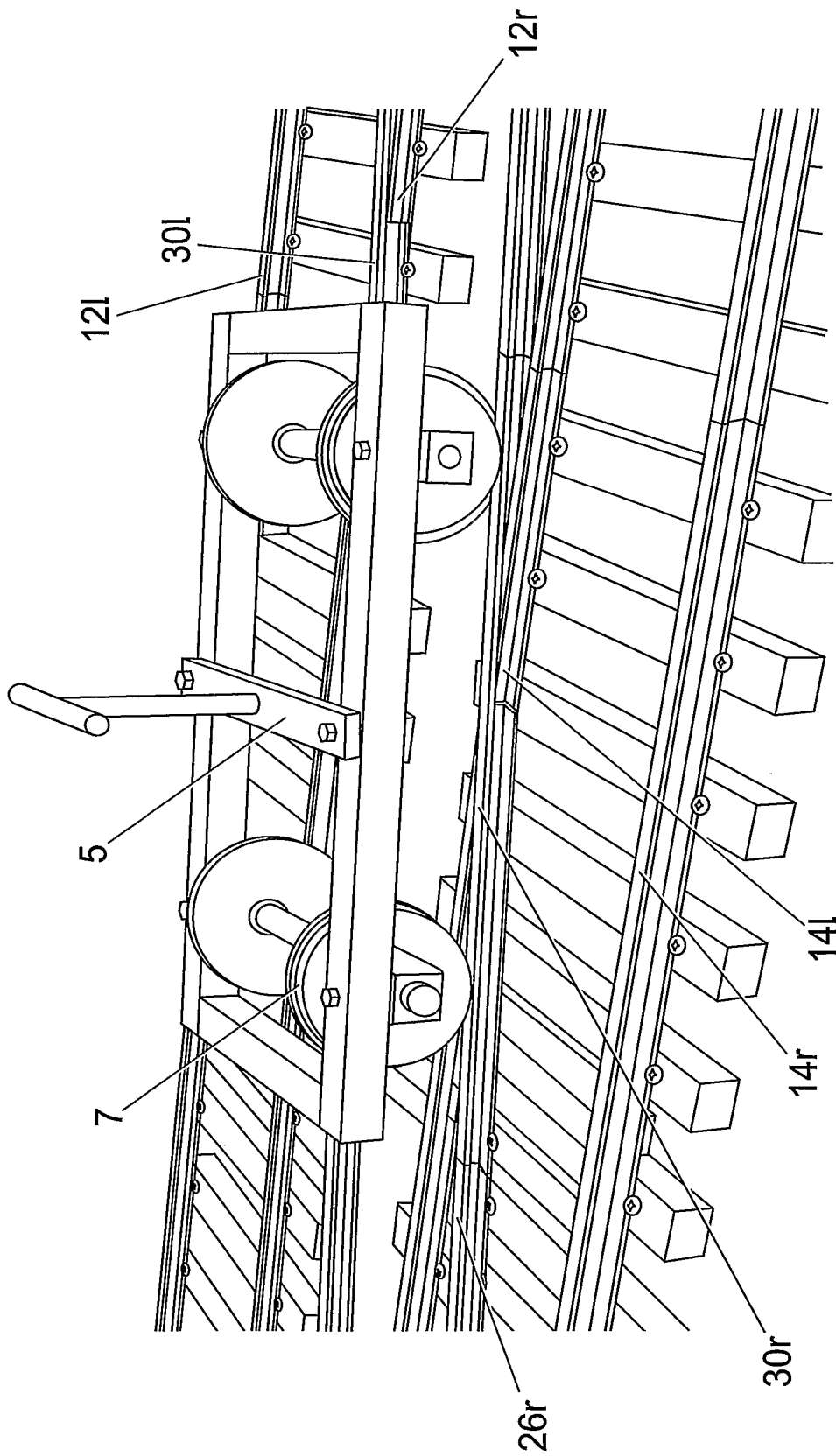


Fig. 16

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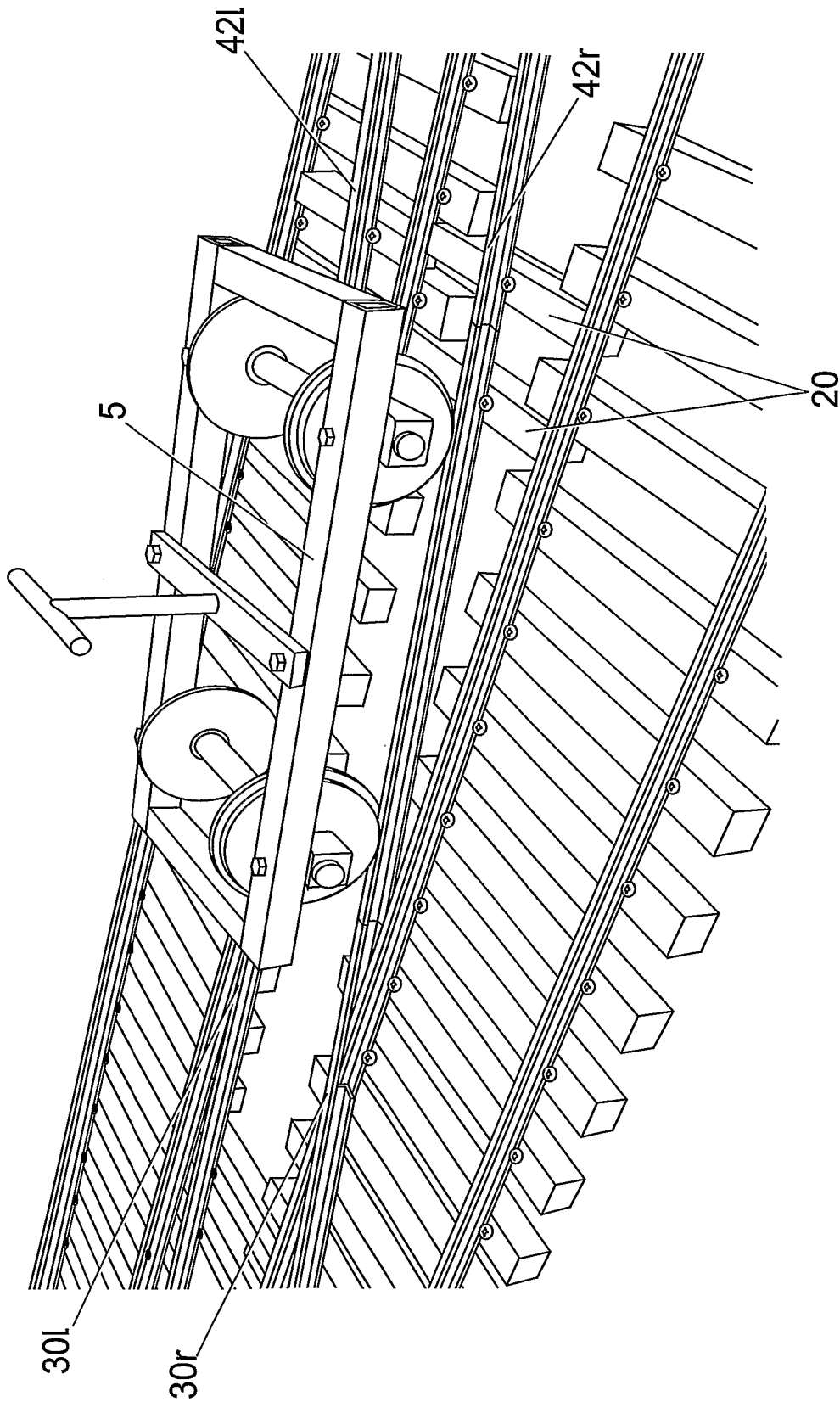


Fig. 17

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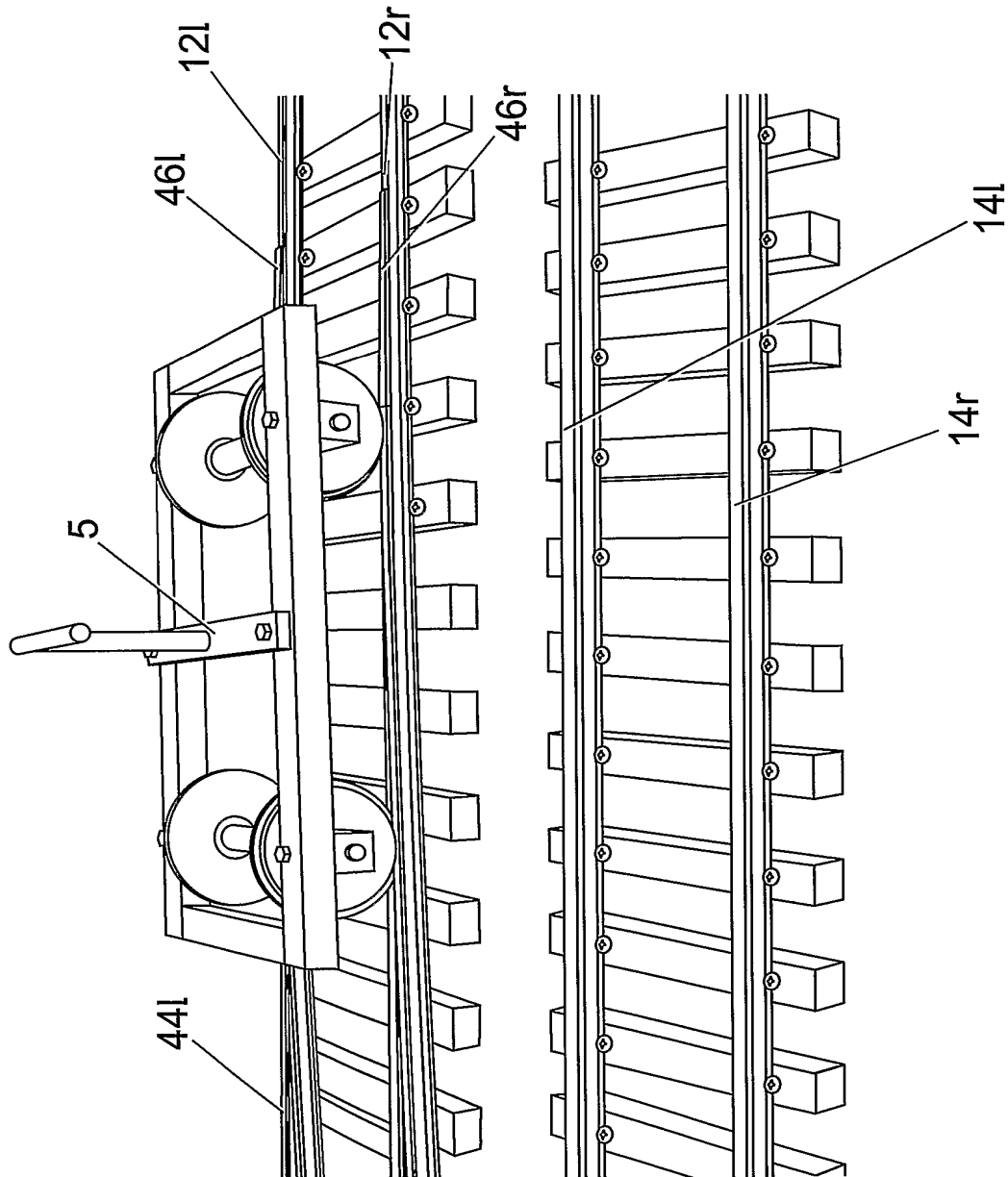


Fig. 18

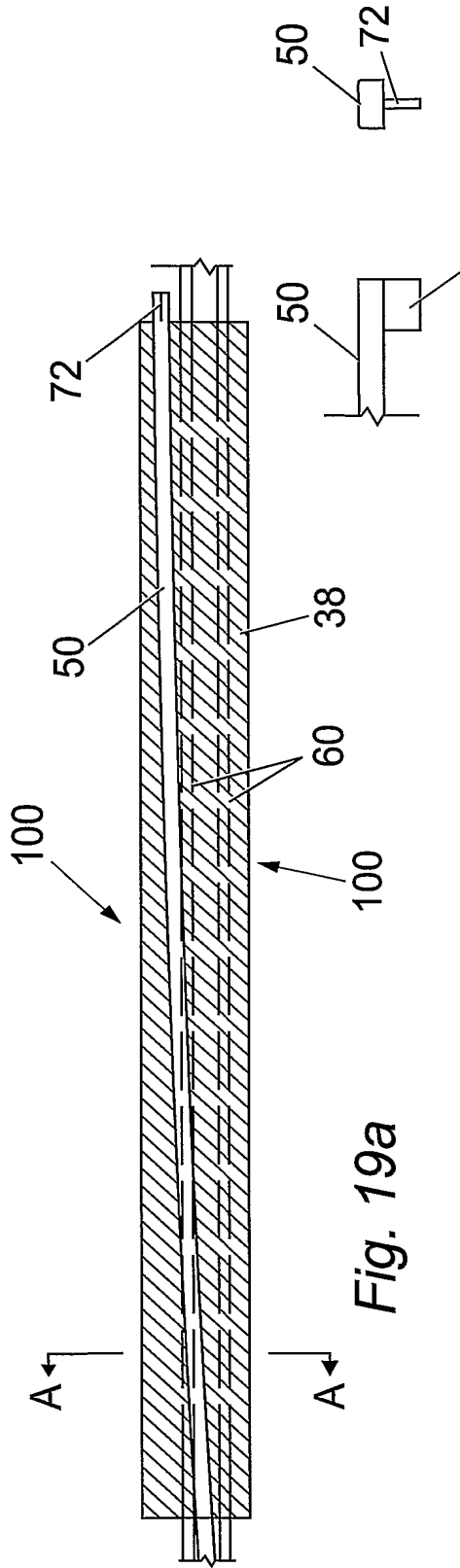


Fig. 19e

Fig. 19f

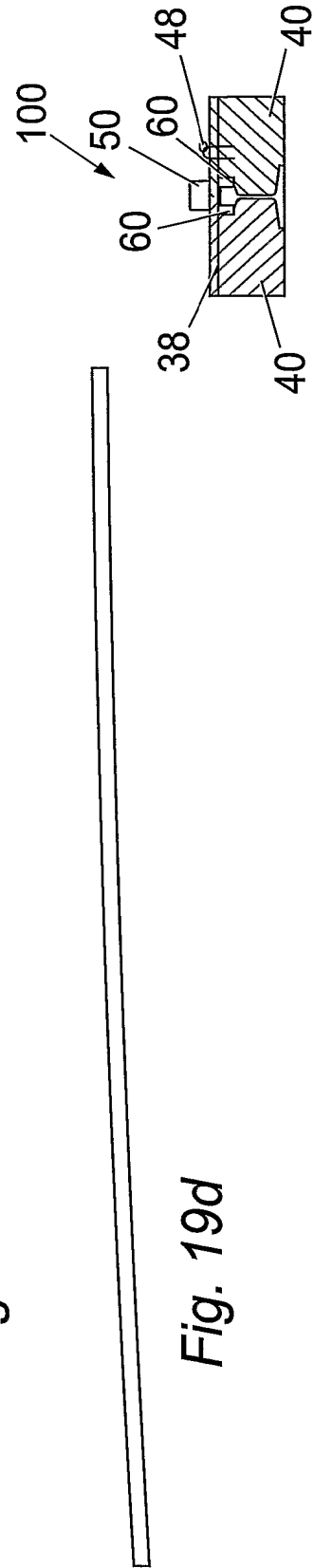
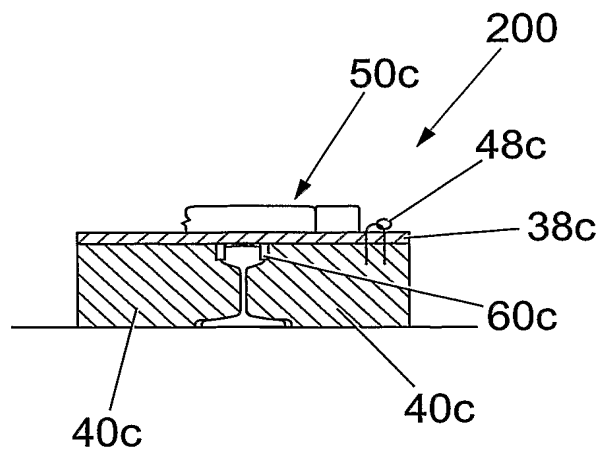
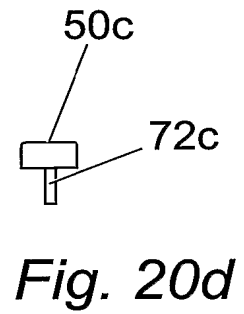
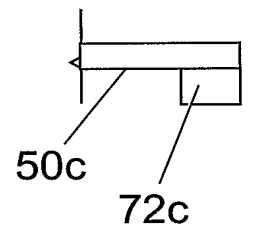
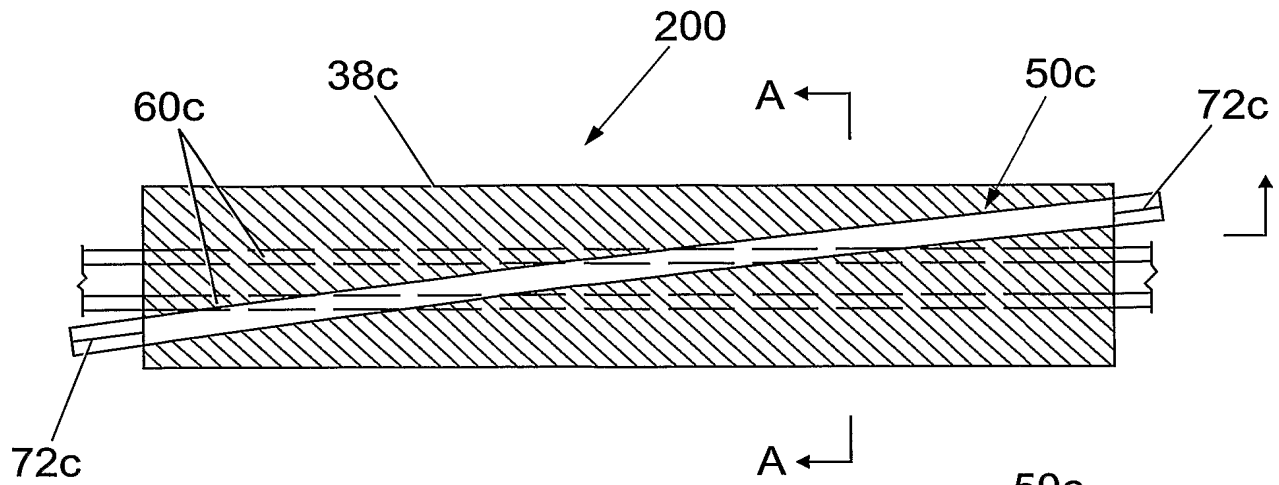


Fig. 19d

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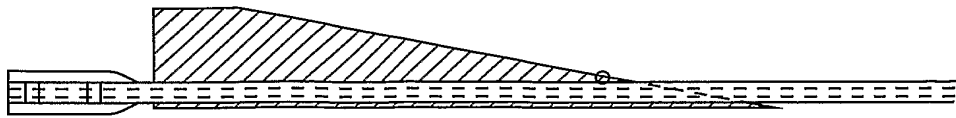


Fig. 21c



Fig. 21d

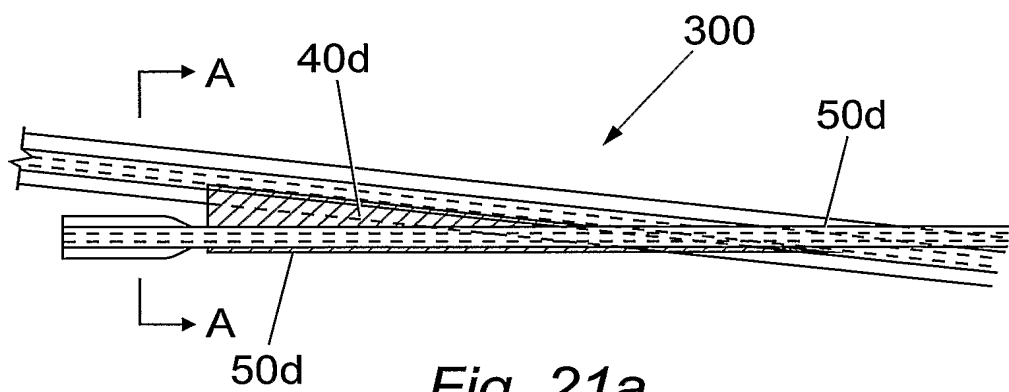


Fig. 21a

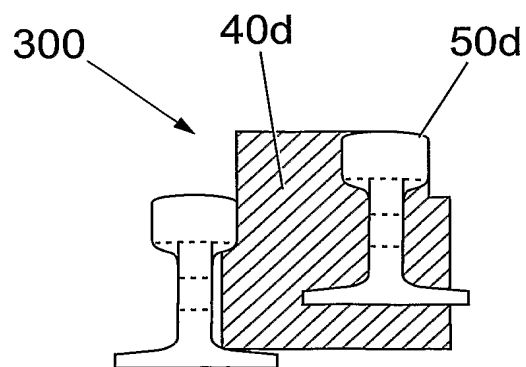


Fig. 21b

Fig. 22a

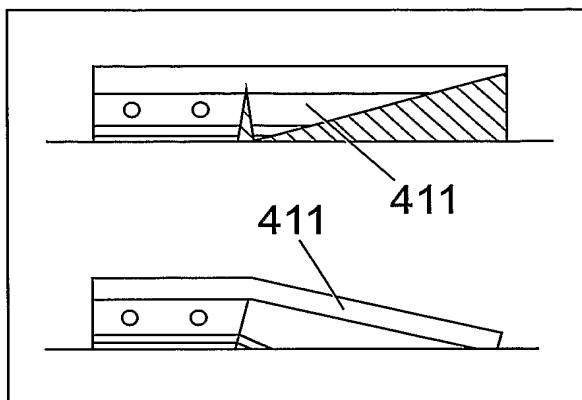


Fig. 22b

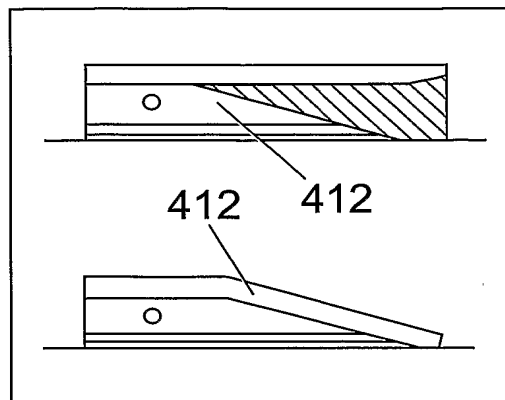


Fig. 22c

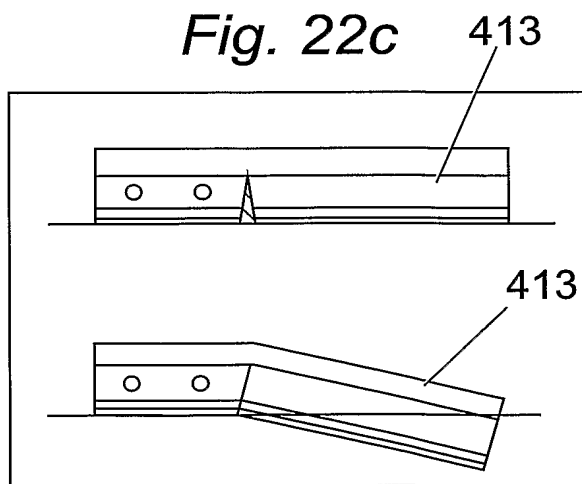
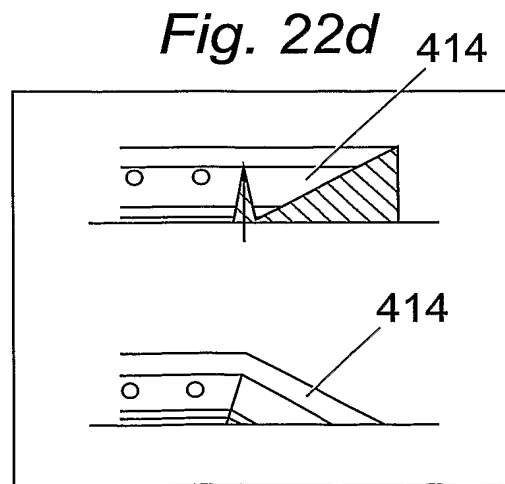


Fig. 22d



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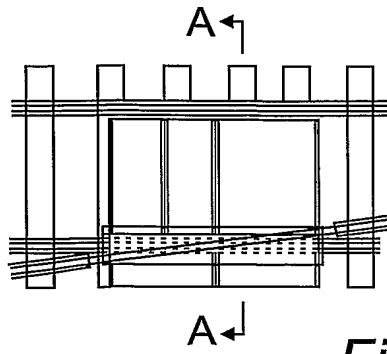


Fig. 23c

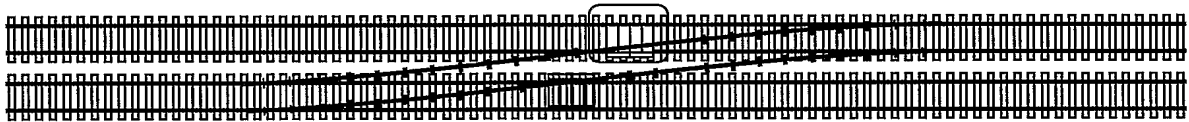


Fig. 23e

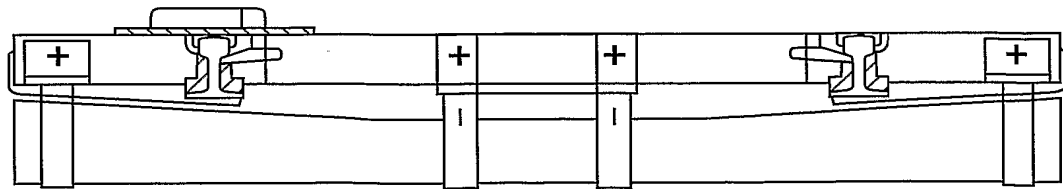
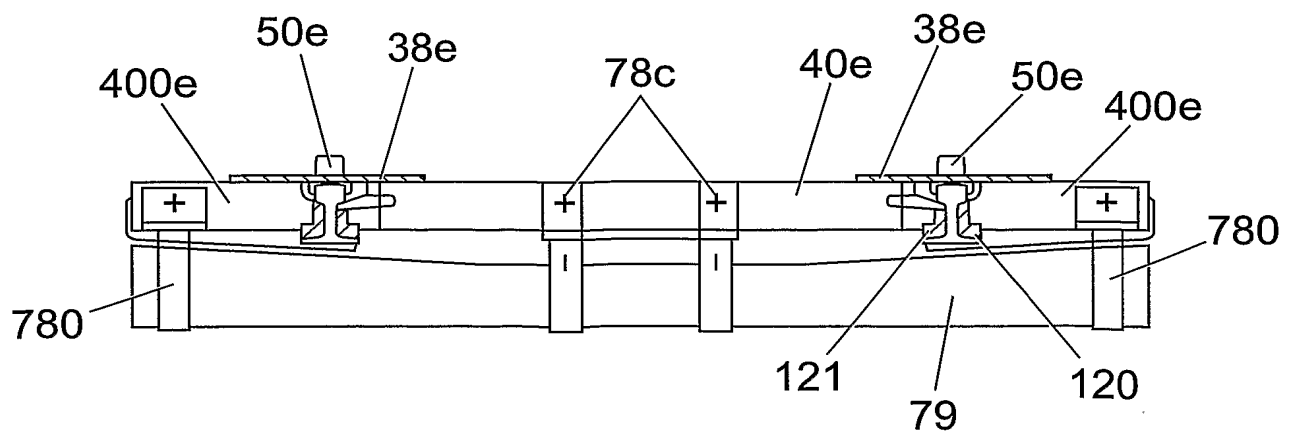
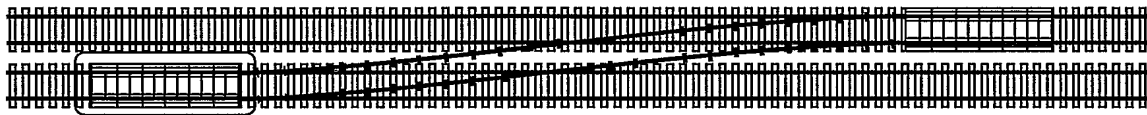
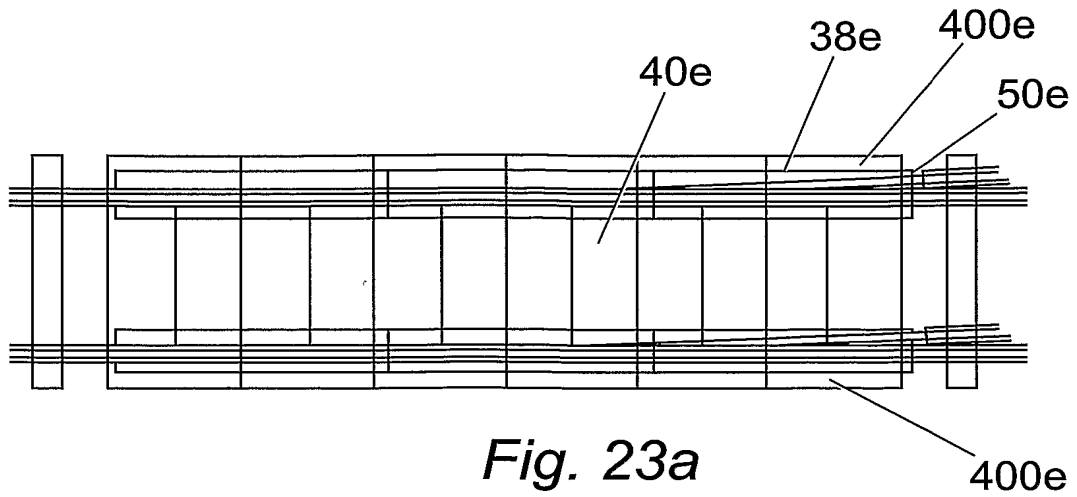


Fig. 23d

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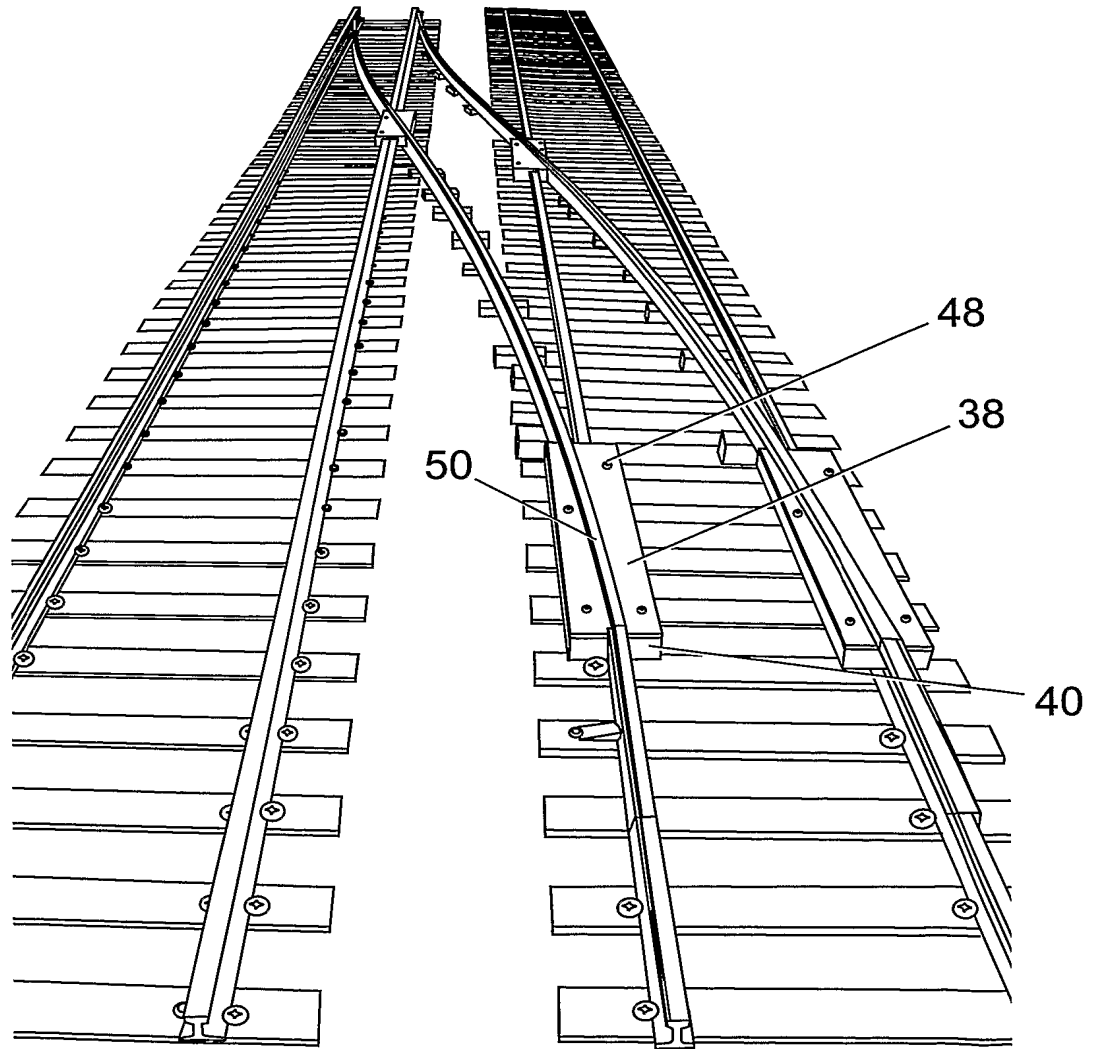


Fig. 24a

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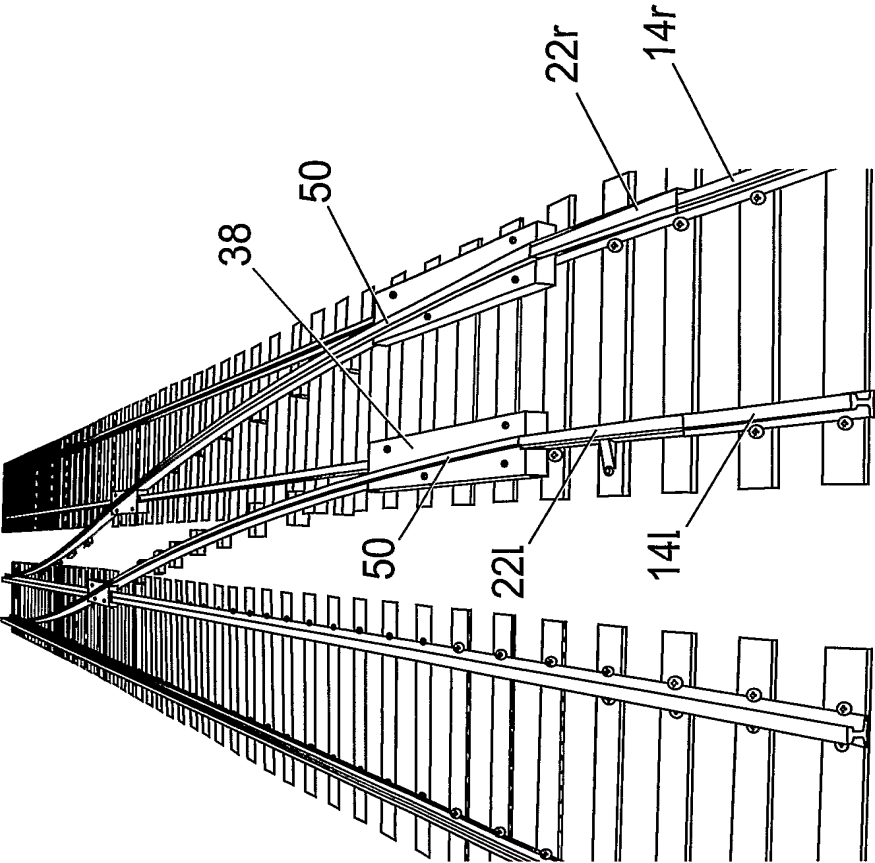


Fig. 24c

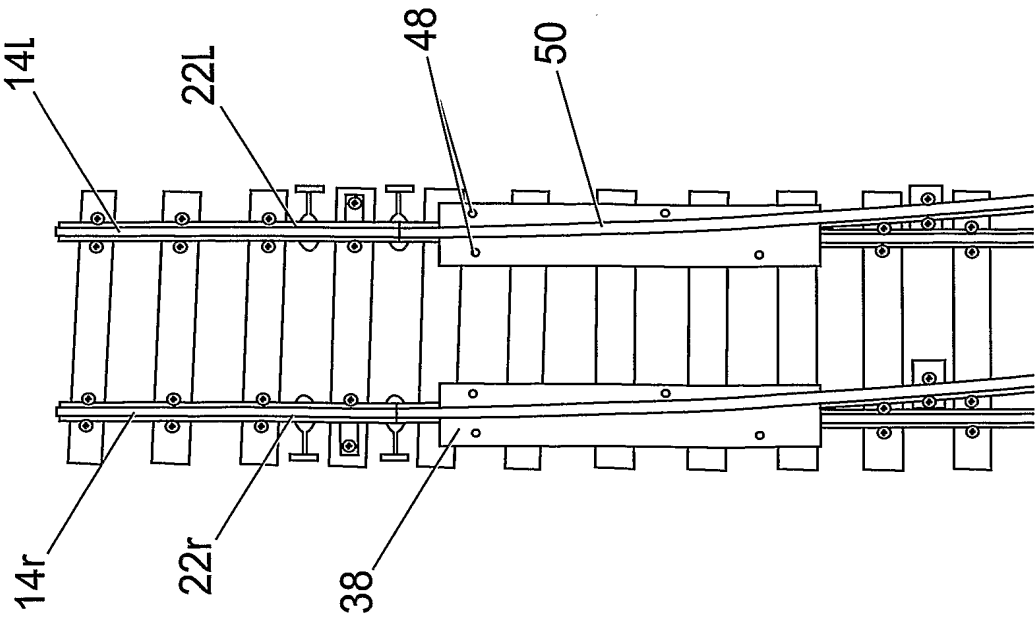
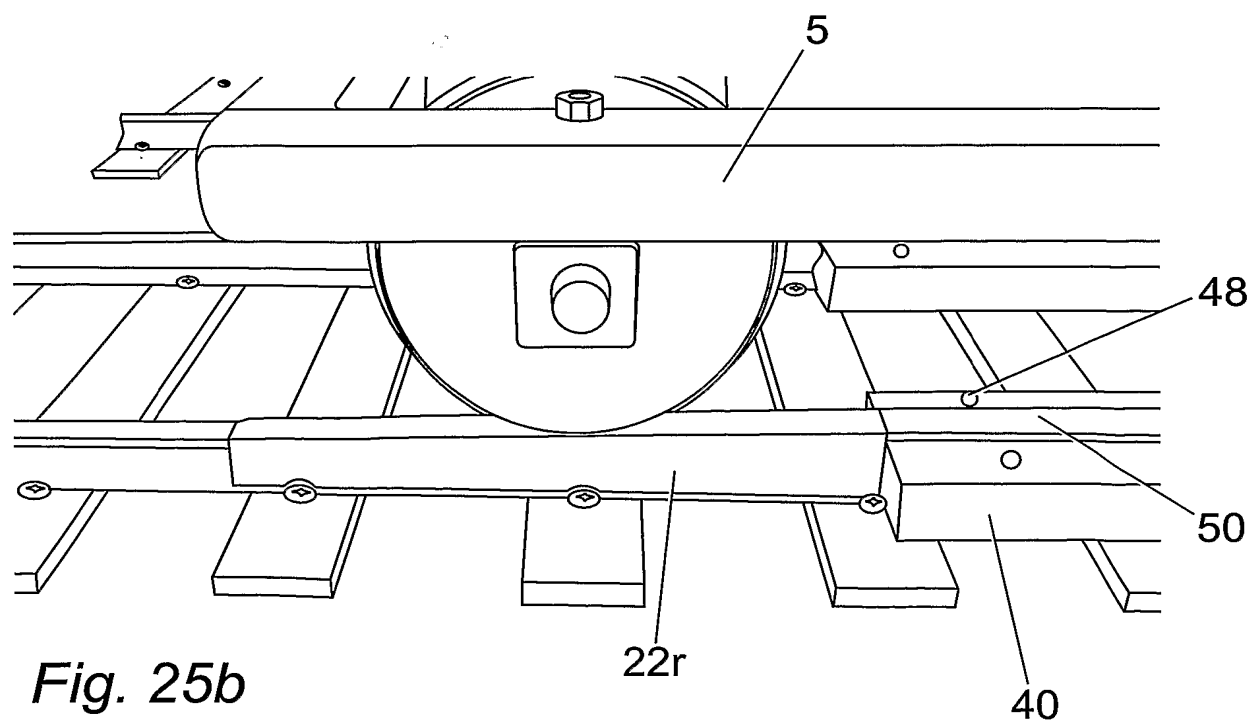
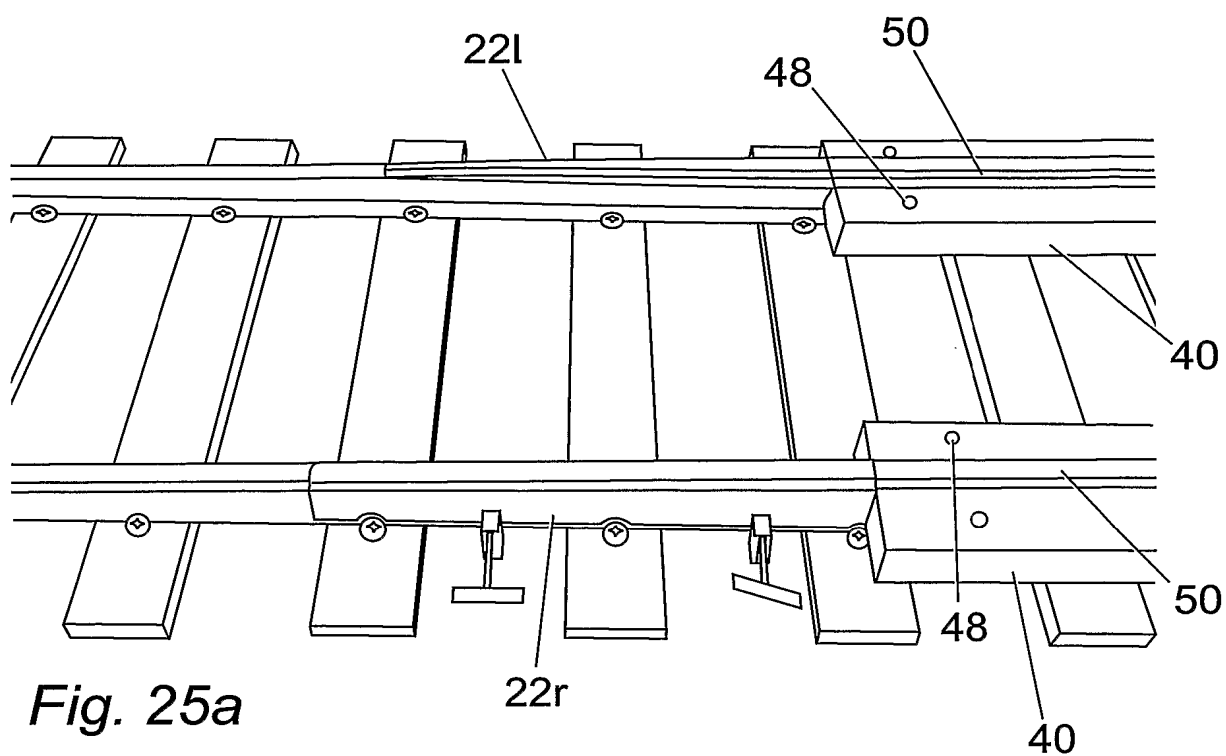
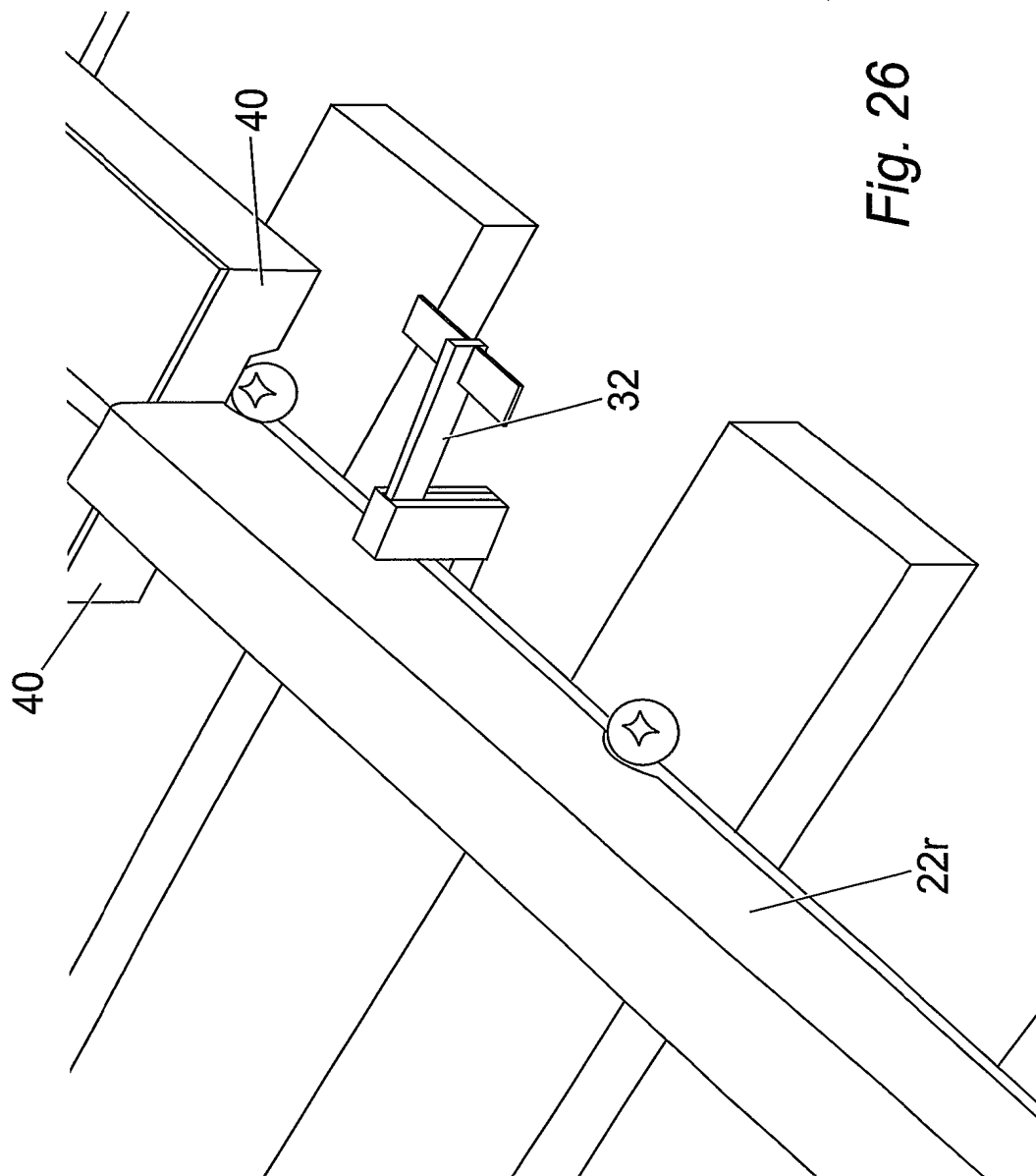


Fig. 24b

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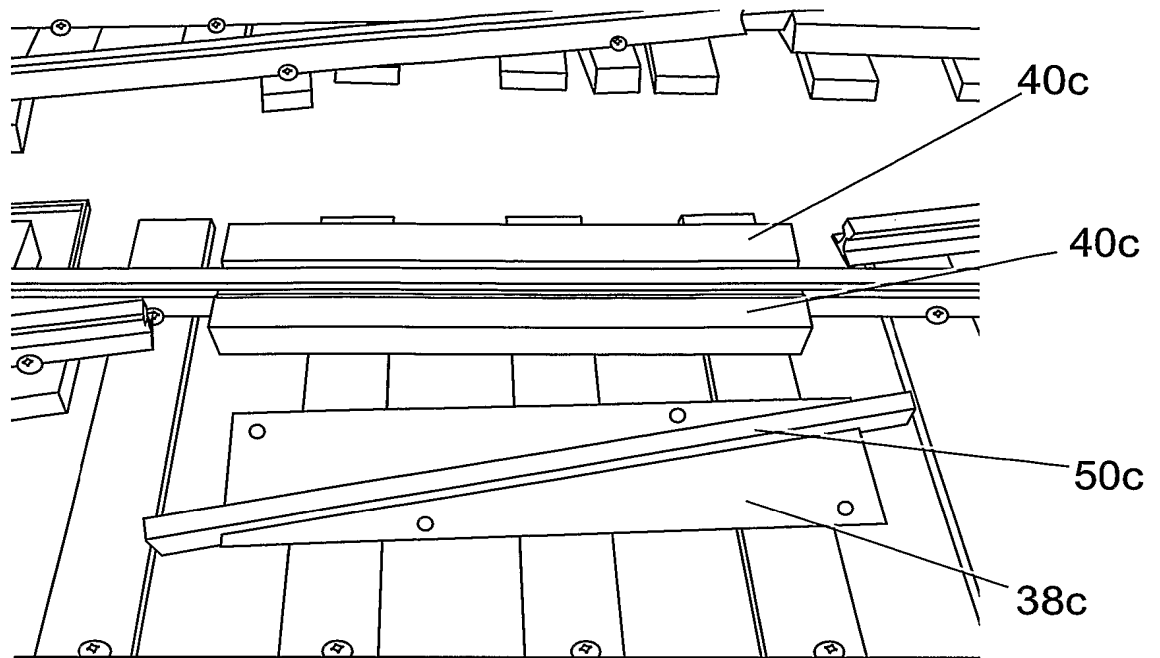


Fig. 27a

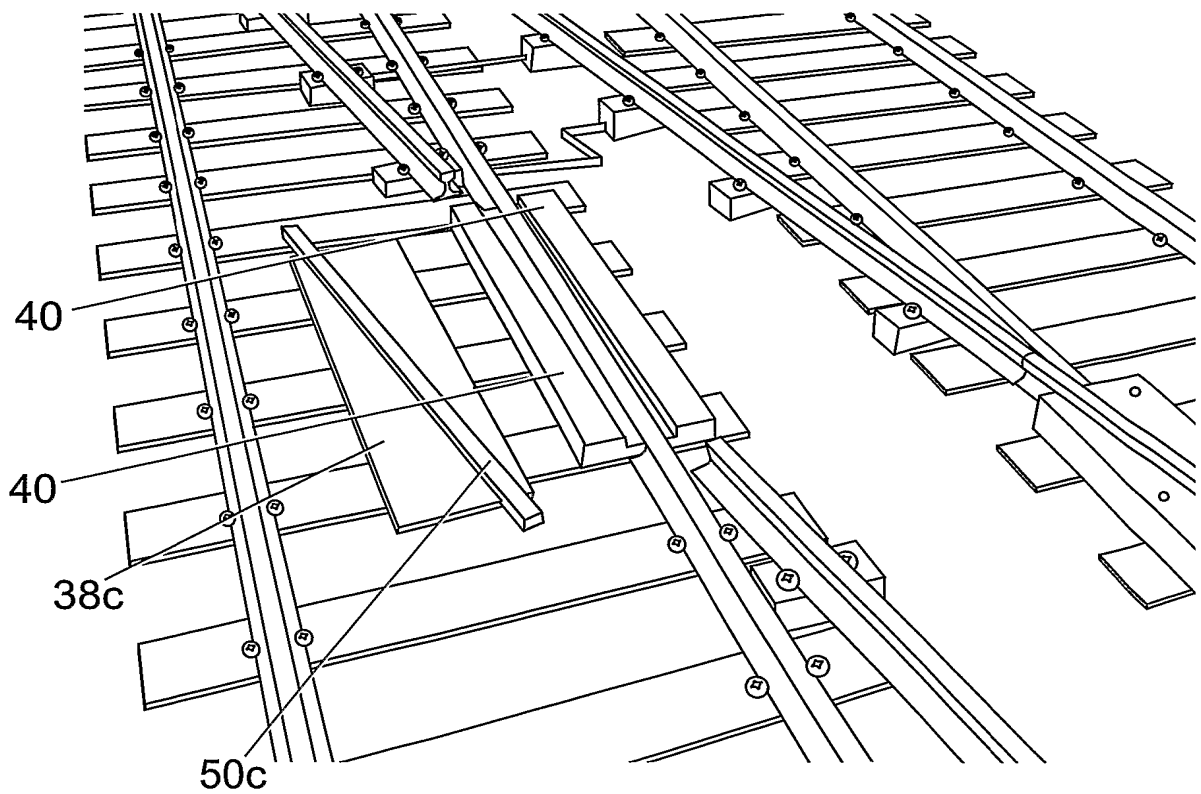


Fig. 28a

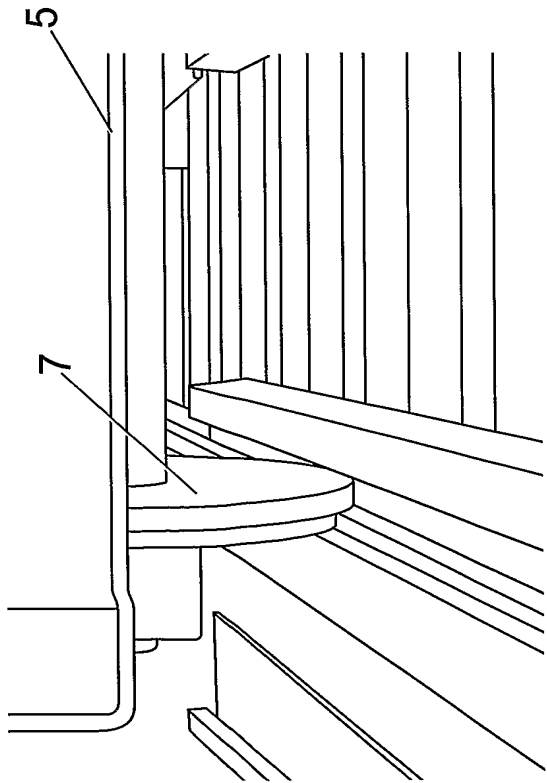


Fig. 29a

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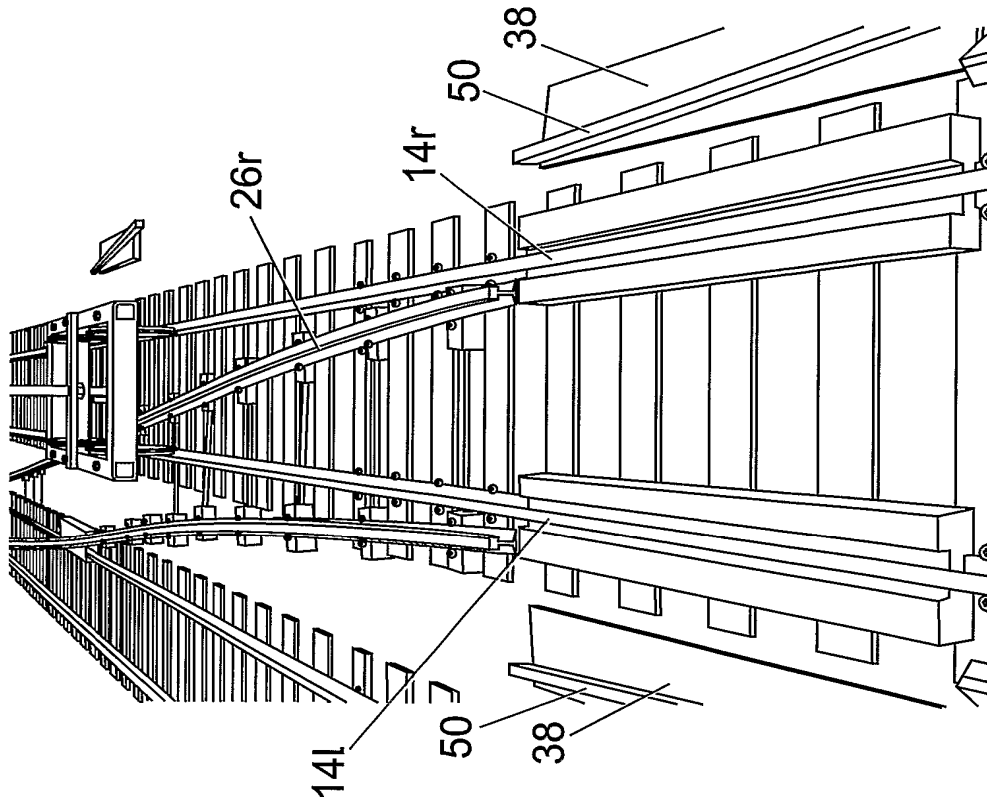


Fig. 29d

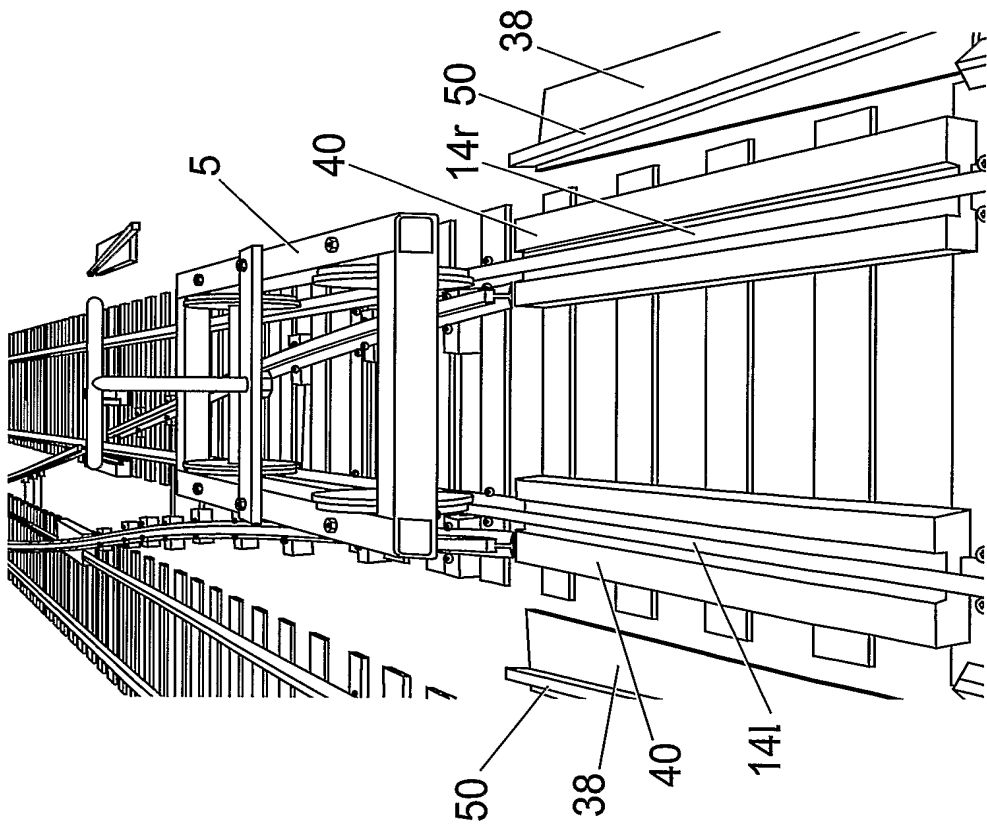


Fig. 29c

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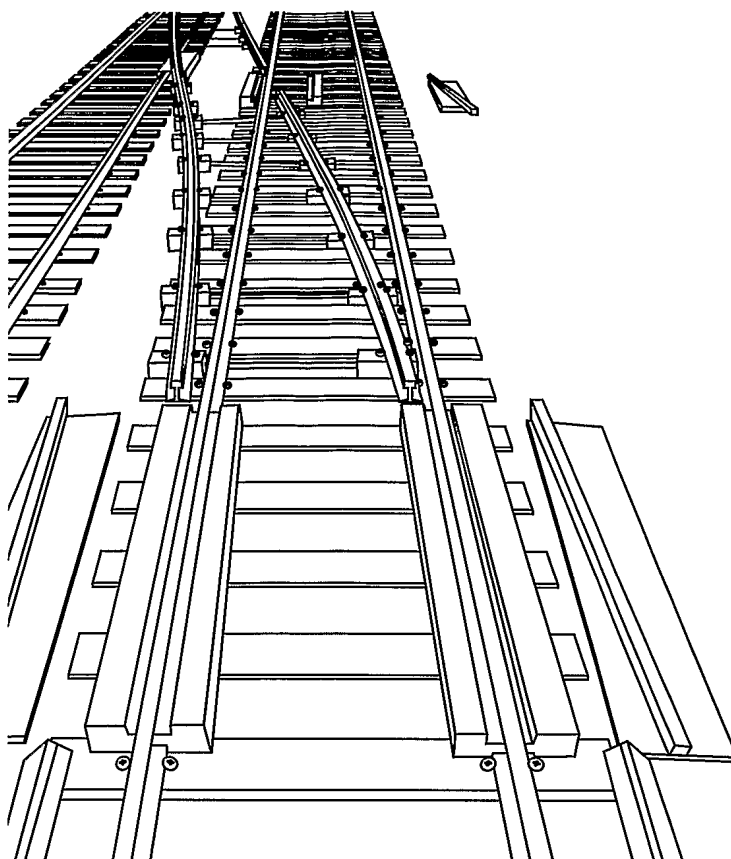


Fig. 29f

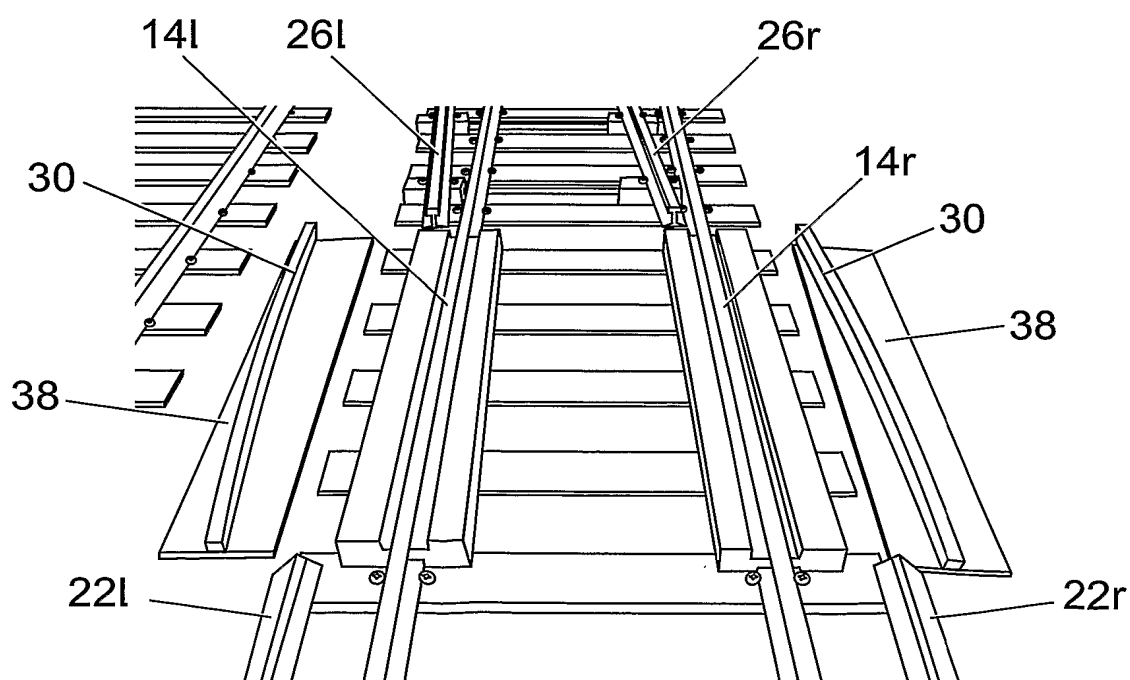


Fig. 29e

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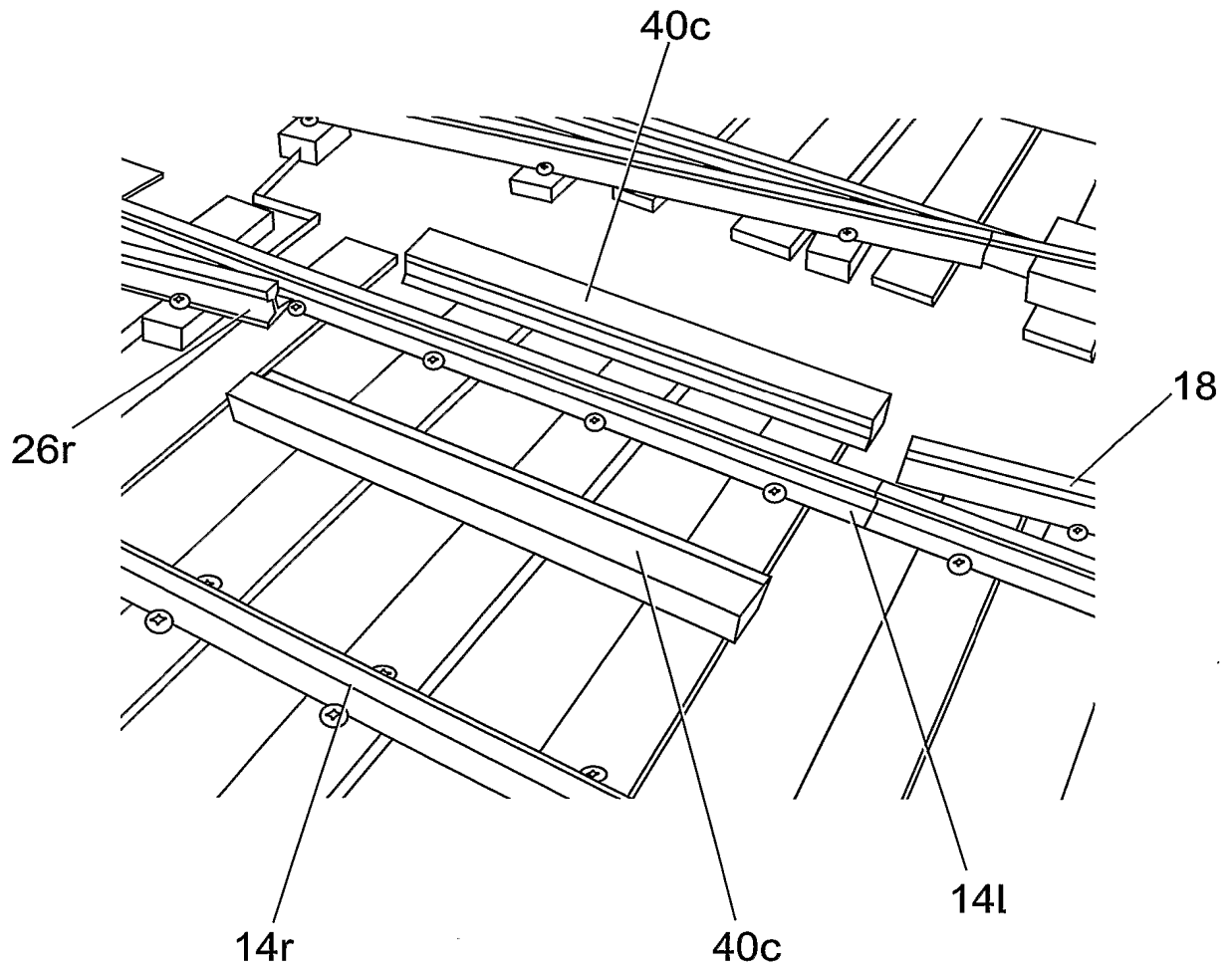


Fig. 29g

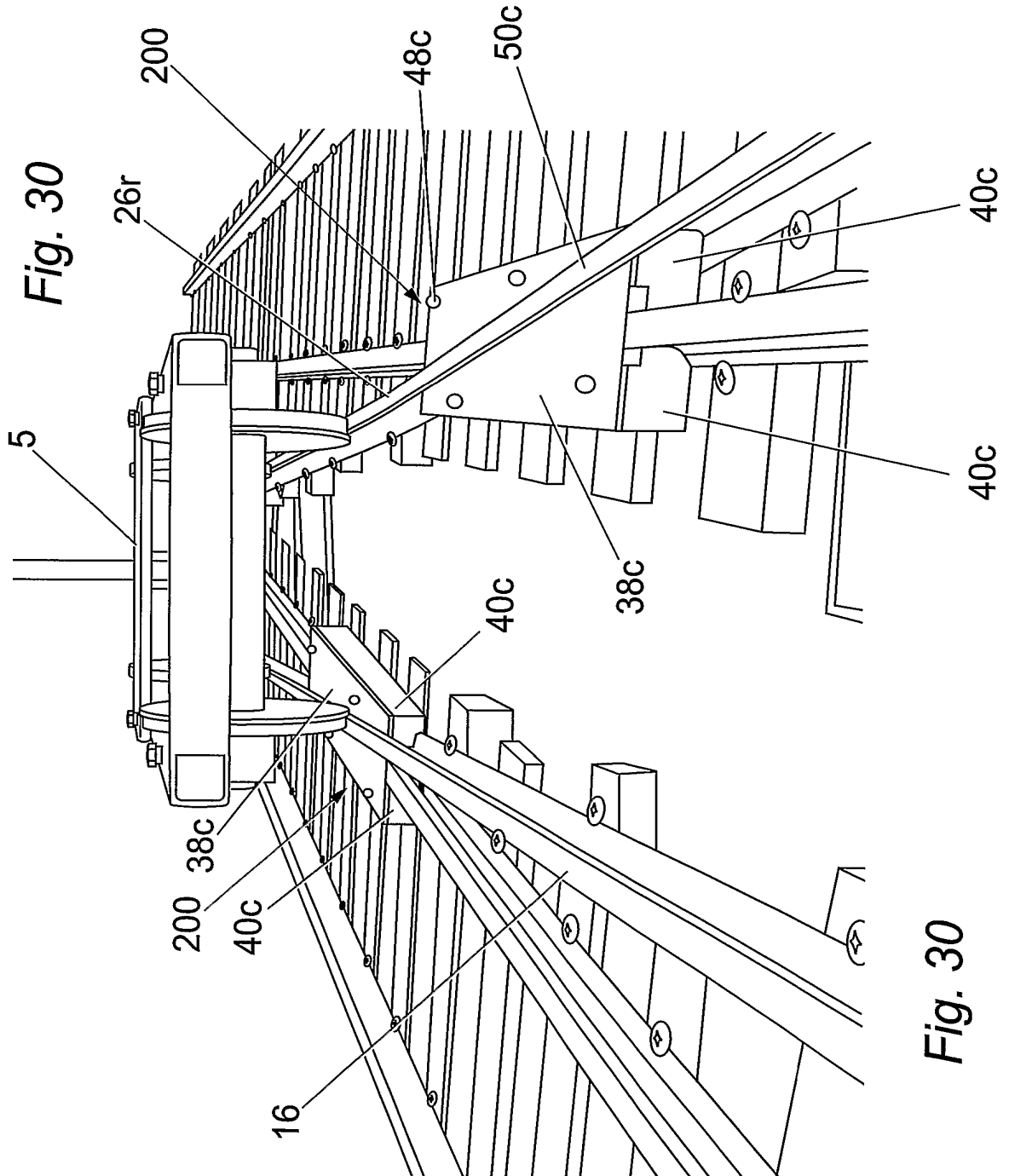


Fig. 30

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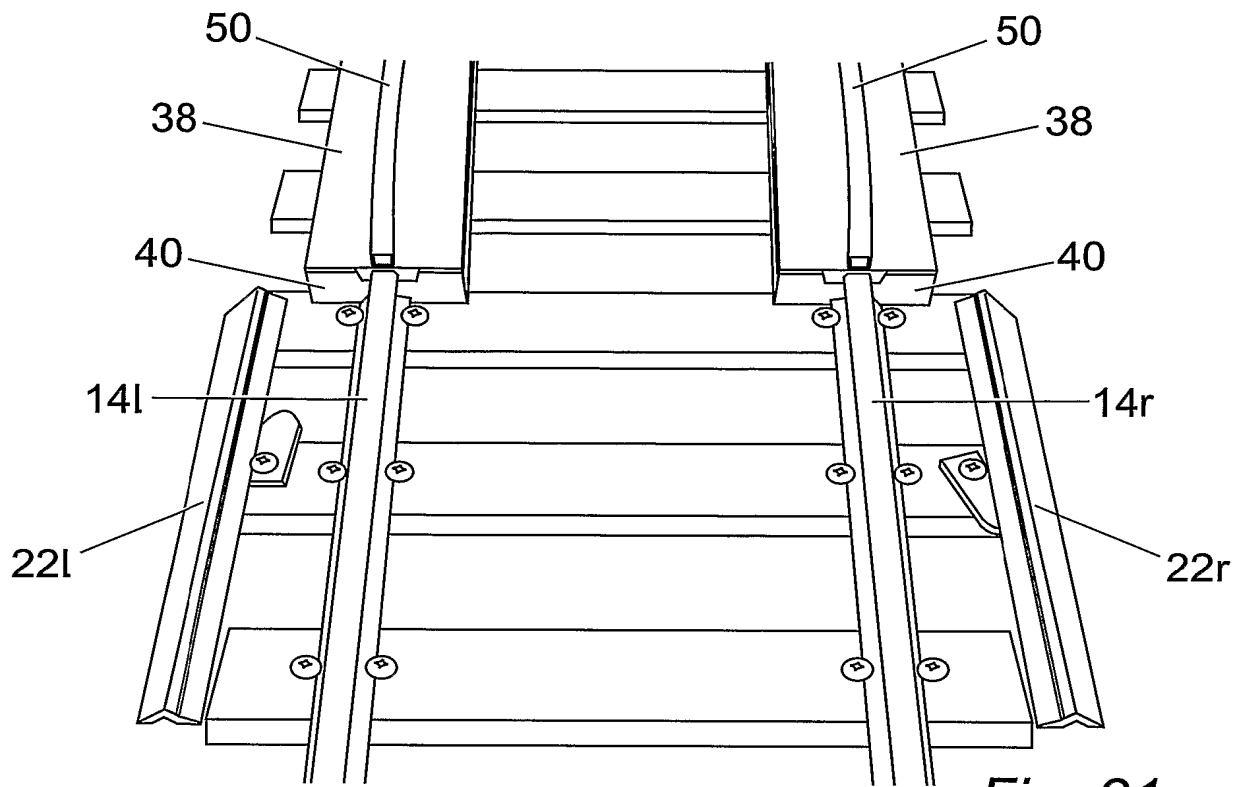


Fig. 31a

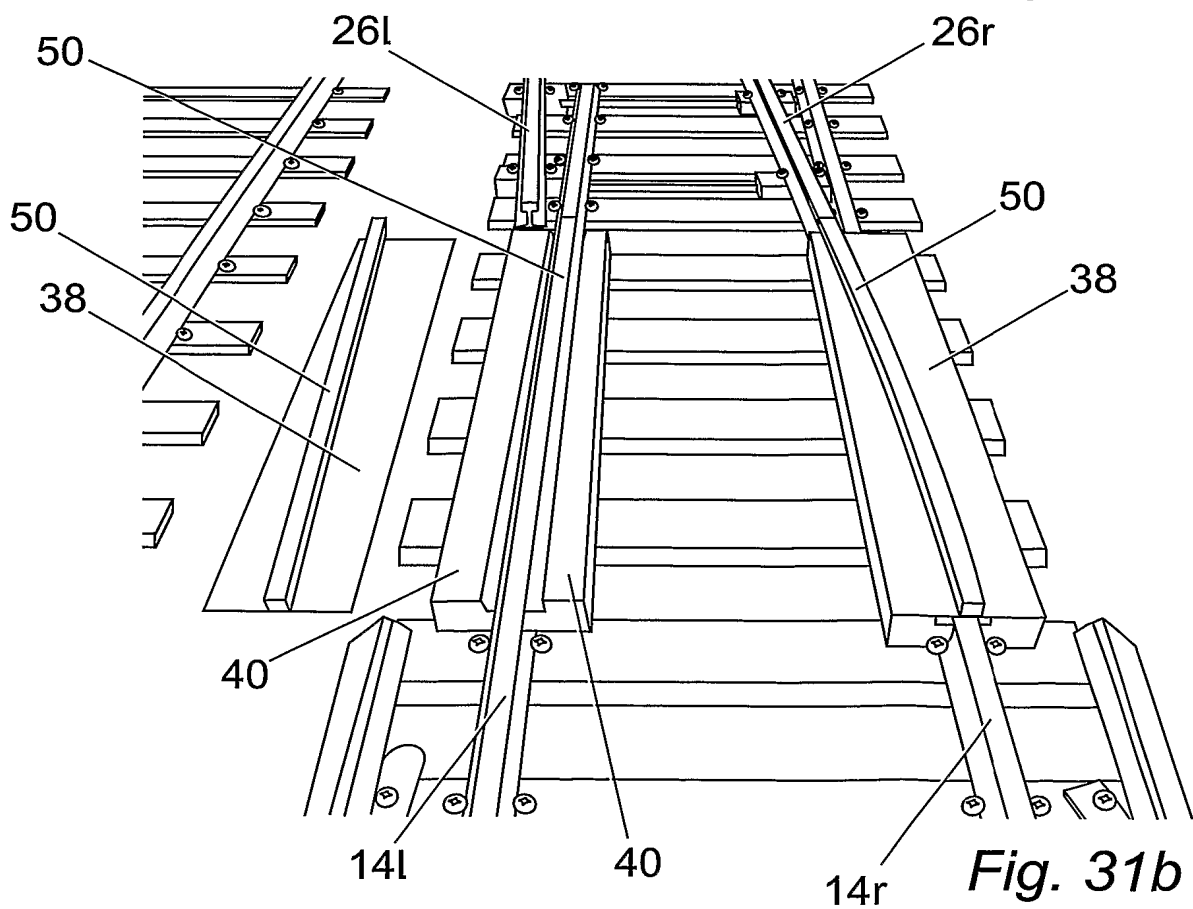


Fig. 31b

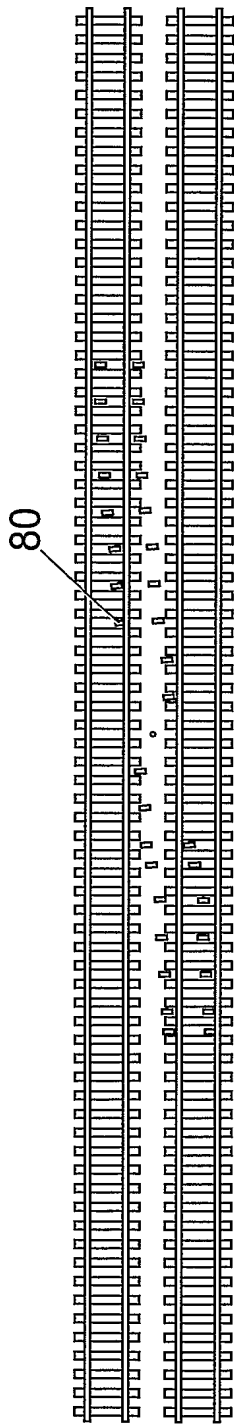


Fig. 32a

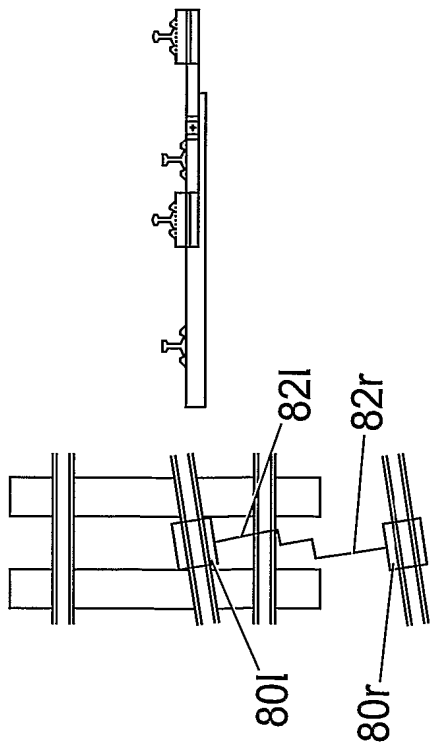


Fig. 32b

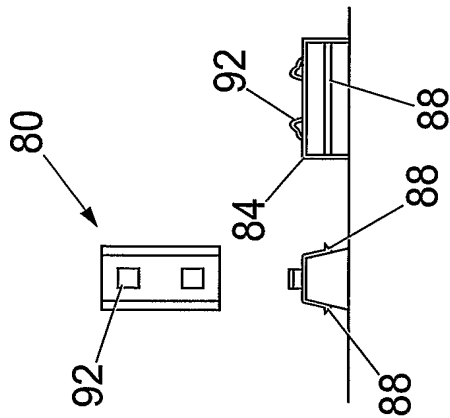


Fig. 32c

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Fig. 33a

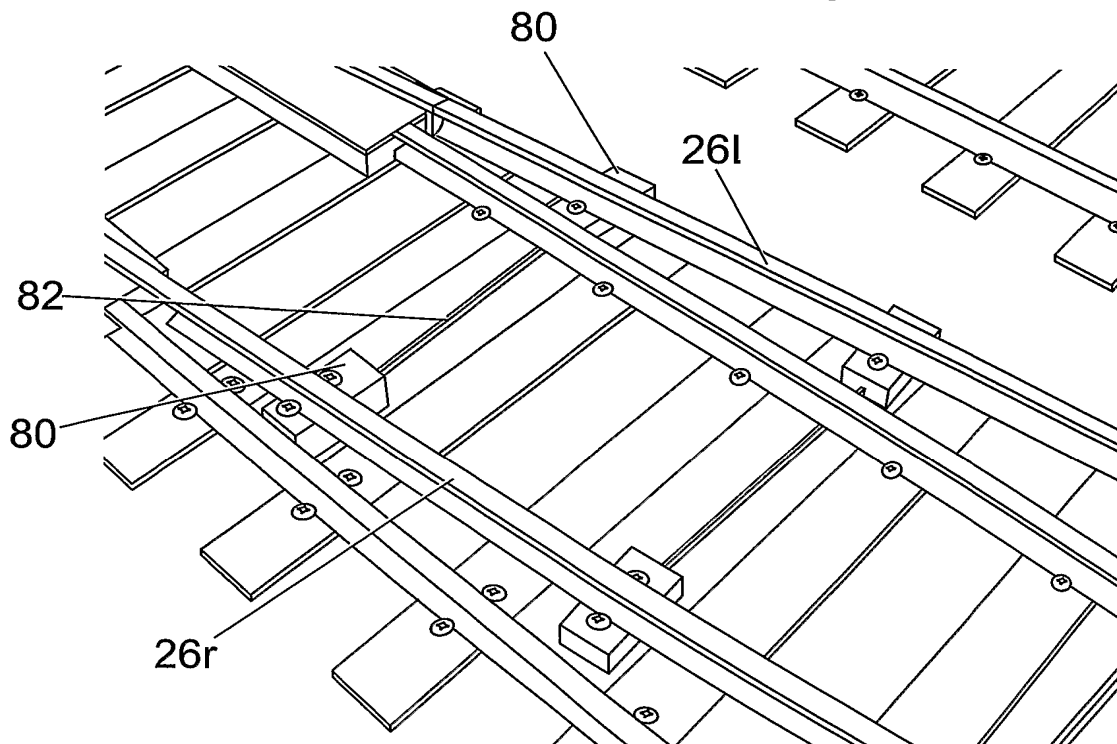
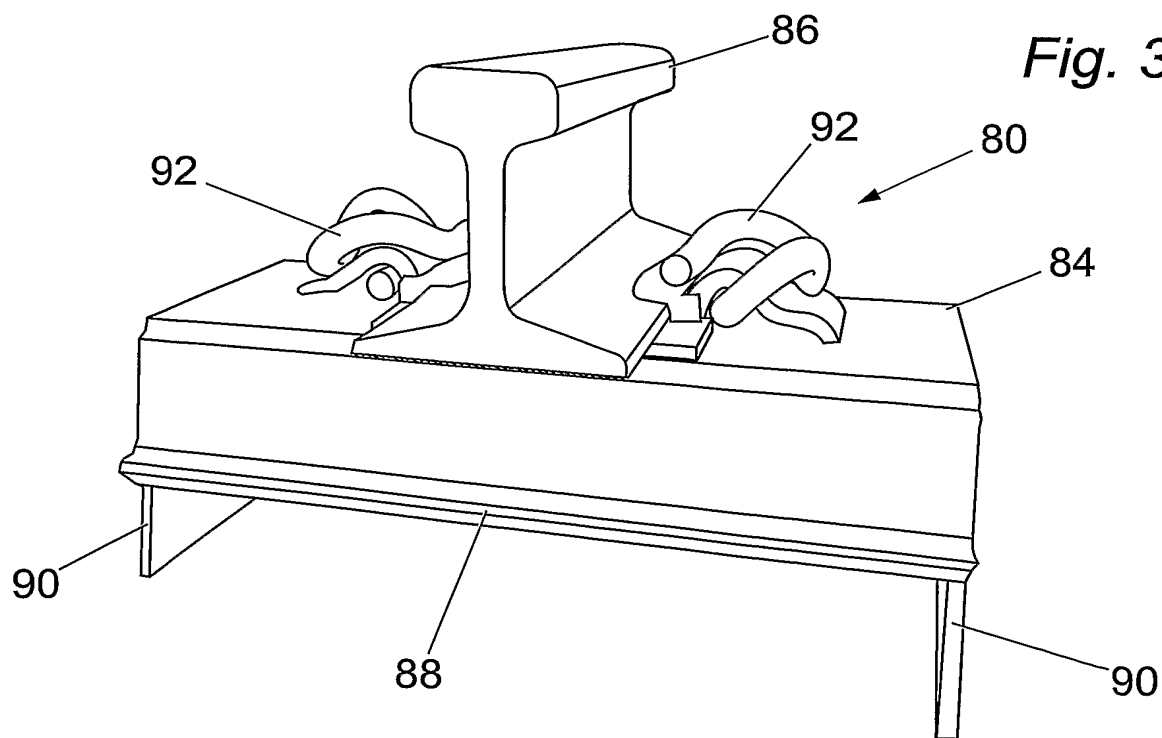
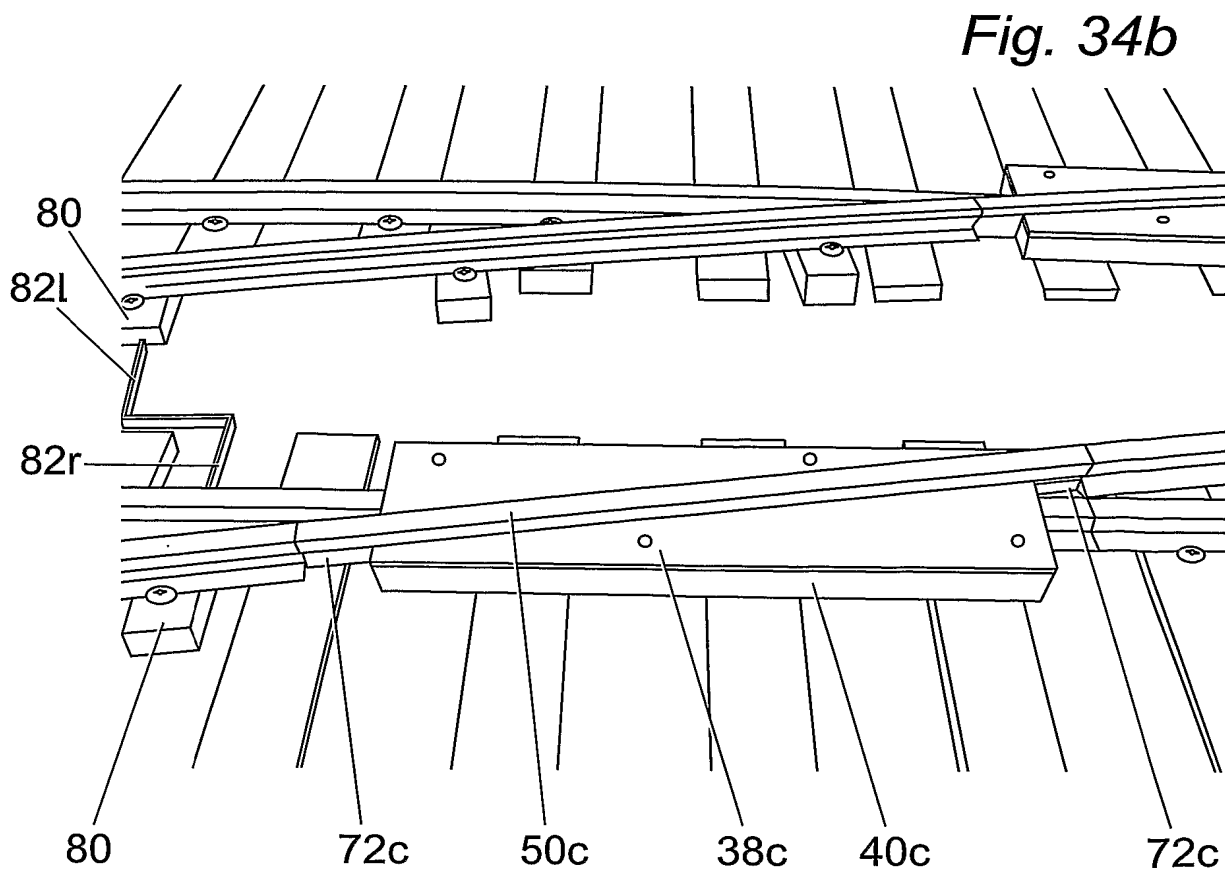
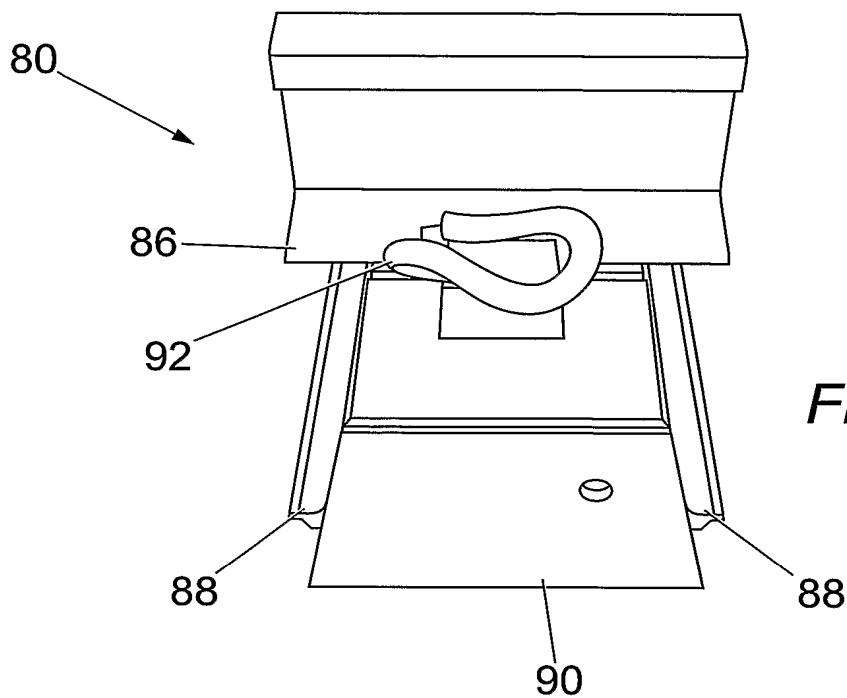


Fig. 33b



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Fig. 35b

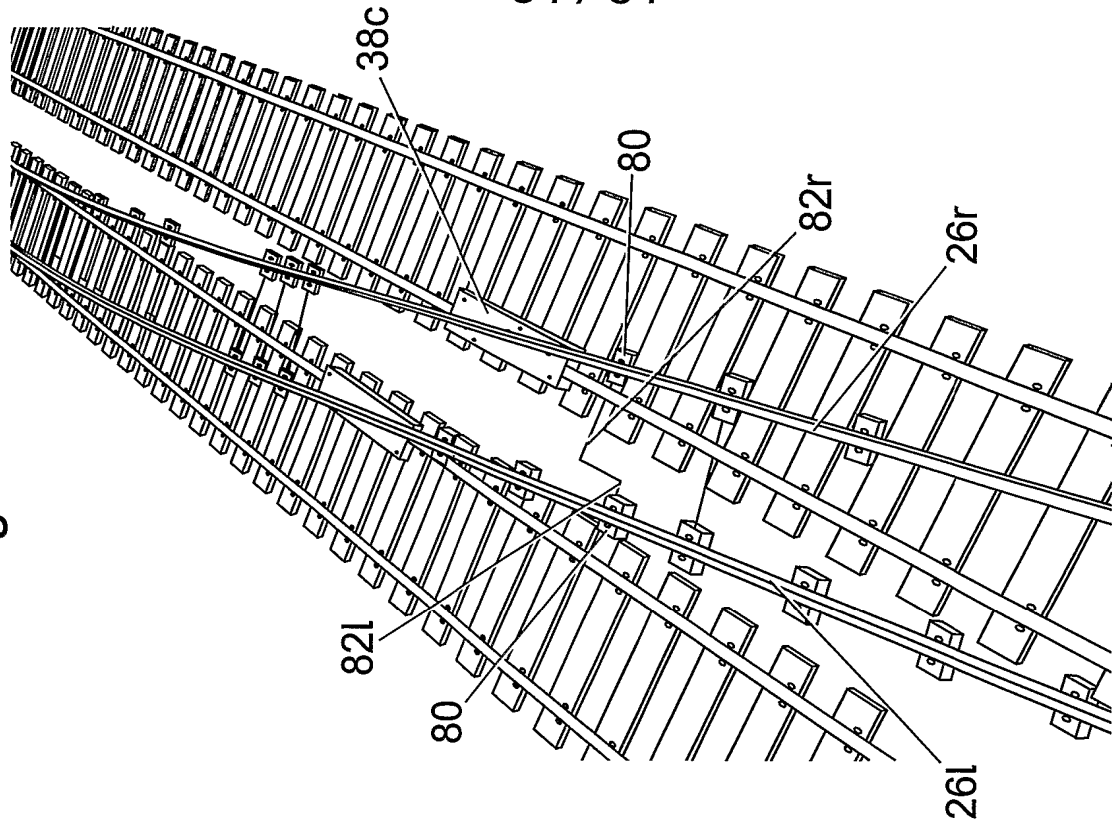
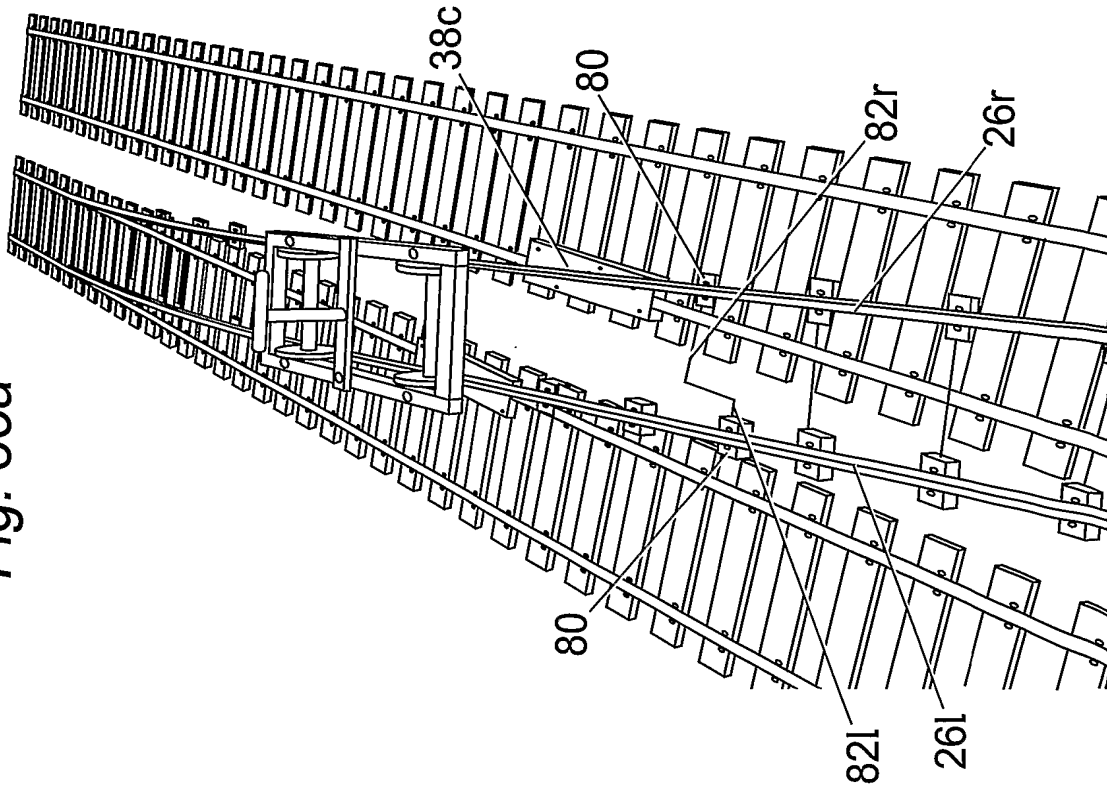


Fig. 35a



INTERNATIONAL SEARCH REPORT

Internat	Application No
PCT/GB	03/03555

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E01B23/06 E01B3/20 E01B3/24 E01B7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1 340 992 A (TORYOWSKI) 25 May 1920 (1920-05-25)	1, 3, 5, 7, 8, 16, 24, 27, 29, 30, 33
Y	page 1, line 10-101; figures 1, 2	2, 31, 34-38
A	---	4, 6, 9, 10, 25, 26
X	US 1 341 354 A (BOOTH) 25 May 1920 (1920-05-25)	1, 3-7, 10, 12, 16, 24, 27, 29, 30, 33
A	page 1, line 53-108; figures 1-3 --- -/--	14, 15, 17, 18

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

23 October 2003

Date of mailing of the international search report

30/10/2003

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

Authorized officer

Kergueno, J

INTERNATIONAL SEARCH REPORT

Intern: Application No
PCT/GB 03/03555

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 26 49 830 A (SOCIETE DES ACIERIES DE PARIS ET D'OUTREAU) 29 September 1977 (1977-09-29)	1,3-7, 30,33
A	page 7, line 19 -page 9, line 13; figures 1,2	26,31,32
X	US 1 493 093 A (BALLOU) 6 May 1924 (1924-05-06)	1,24,27, 30,33
A	page 1, line 46 -page 2, line 37; figures 1-12	10,11,19
X	US 1 480 739 A (BAGBY) 15 January 1924 (1924-01-15)	1,3,5,6, 10,24, 27,30,33
	page 1, line 57 -page 2, line 79; figures 1-3	
X	GB 197 789 A (FRANKS) 24 May 1923 (1923-05-24)	39,41,42
Y		44
A	page 2, line 52-76; figures 1-3	40
Y	DE 165 316 C (FITZGERALD) page 1, line 11-35; figure	2,31, 34-38
Y	US 1 405 556 A (ODENKIRK) 7 February 1922 (1922-02-07) figure 1	44
A	DE 11 67 371 B (MASCHINENFABRIK DEUTSCHLAND AKT.) 9 April 1964 (1964-04-09) figures 1,2	25
A	DE 31 723 C (WESTBROOK) page 1, left-hand column, line 1-8; figure 1	47

INTERNATIONAL SEARCH REPORT

Int. application No.
PCT/GB 03/03555

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-38

A turnout apparatus, a method of allowing normal running of a train along one of a first and a second existing railway track, and a method which enables single line working on a second railway track to clear a first railway track

2. Claims: 39-47

A pot sleeper for supporting a rail of a railway track and a method of installing and/or maintaining a pot sleeper

INTERNATIONAL SEARCH REPORT

ation on patent family members

Internat .pplication No
PCT/GB 03/03555

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